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DOMINION OF CANADA

ROYAL COMMISSION

QUEBEC BRIDGE INQUIRY

MINUTES OF PROCEEDINGS

QUEBEC, P.Q., September 9, 1907.

The Royal Commission appointed to conduct an investigation into the cause of the collapse of the Quebec bridge in the course of construction over the St. Lawrence river, near the city of Quebec, and into all matters incidental thereto, met this day in the Criminal Assize Courtroom in the Courthouse.

PRESENT:—HENRY HOLGATE, Esquire, C.E., Chairman;
JOHN G. G. KERRY, Esquire, C.E., and
JOHN GALBRAITH, Esquire, Professor of Engineering,
Commissioners.

The following counsel appeared before the commission:—

John Hampton Barnes, Esquire, Philadelphia, U.S.A., and G. G. Stuart, K.C., Quebec, representing the Phœnix Bridge Company.

Ferdinand Roy, Esquire, representing the Quebec Bridge Company, and

W. H. Davidson, Esquire, representing the International Association of Bridge Workers and the Bridge and Structural Iron Workers' Union.

In opening the inquiry Mr. Holgate said:—

As preliminary to the opening of proceedings in connection with the investigation into the collapse of the Quebec bridge, it is necessary to read the commission the authority under which this Royal Commission sits, so that I shall read the whole document. It is as follows:—

7-8 EDWARD VII., A. 1908

GREY.

(Seal)

CANADA.

EDWARD THE SEVENTH, *by the Grace of God, of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, King, Defender of the Faith, Emperor of India.*

To all to whom these Presents shall come, or whom the same may in anywise concern,

GREETING:

Whereas, in and by an order of Our Governor General in Council, bearing date the thirty-first day of August, in the year of Our Lord One thousand nine hundred and seven, provision has been made for an investigation by Our Commissioners therein and hereinafter named into the cause of the collapse of the Quebec Bridge, in the course of construction over the St. Lawrence River, near the City of Quebec, in the Province of Quebec, on the twenty-ninth August, 1907, and into all matters incidental thereto.

Now know ye, that by and with the advice of Our Privy Council for Canada, We do by these Presents nominate, constitute and appoint:

Henry Holgate, of the City of Montreal, in the Province of Quebec, Civil Engineer, John G. G. Kerry, of Campbellford, in the Province of Ontario, Civil Engineer, and John Galbraith, of the City of Toronto, in the Province of Ontario, Dean of the Faculty of Applied Science and Engineering and Professor of Engineering in the University of Toronto, to be Our Commissioners to conduct such inquiry.

To have, hold, exercise and enjoy the said office, place and trust unto the said Henry Holgate, John G. G. Kerry and John Galbraith, together with the rights, powers, privileges and emoluments unto the said office, place and trust, of right and by law appertaining, during pleasure.

And we do hereby, under the authority of the Inquiries Act, Chapter 104 of the Revised Statutes, 1906, confer upon Our said Commissioners, the power of summoning before them any witnesses, and of requiring them to give evidence on oath, or on solemn affirmation if they are persons entitled to affirm in civil matters, and orally or in writing, and to produce such documents and things as Our said Commissioners shall deem requisite to the full investigation of the matters into which they are hereby appointed to examine.

And We do hereby require and direct Our said Commissioners to report to Our Governor General in Council the result of their investigation, together with the evidence taken before them, and any opinion they may see fit to express thereon.

In testimony whereof, We have caused these, Our letters to be made patent and the Great Seal of Canada to be hereunto affixed. Witness, Our Right Trusty and Right Well-beloved Cousin, The Right Honourable Sir Albert Henry George, Earl Grey, Viscount Howick, Baron Grey of Howick in the County of Northumberland, in the Peerage of the United Kingdom and a Baronet; Knight Grand Cross of Our Most Distinguished Order of Saint Michael and Saint George, &c., &c., Governor General and Commander in Chief of our Dominion of Canada.

At Our Government House, in Our City of Ottawa this thirty-first day of August in the Year of Our Lord, One thousand nine hundred and seven, and in the seventh Year of Our Reign.

By Command.

F. COLSON,
Acting Under-Secretary of State.

E. L. NEWCOMBE,
Deputy of the Minister of Justice, Canada.

Mr. HOLGATE continued:—This is essentially a commission of inquiry, and our sole purpose is to make the inquiry thorough. We must rely to a very large extent on the co-operation of everyone having definite knowledge as to actual occurrences and we would like to keep as close to that as possible. My fellow commissioners and myself would like all who have knowledge of the matter to give evidence. We may perhaps not be able to find everyone who could give evidence, but we would be very glad to have information that will lead us in that direction from whatever source it may be had. In the course of the examination of witnesses we would like to conduct the examination directly ourselves; but will be very glad of any suggestions that anyone in the room may have to offer, especially the legal gentlemen, so that during the course of the examination, if we are not successful in covering the point, which, in the opinion of others, should be covered, we want no hesitation on the part of these gentlemen in drawing our attention to that and we would be very glad to pursue that investigation as far as necessary.

Mr. JOHN HAMPTON BARNES.—Mr. Chairman, before you commence proceedings, I wish to state that I am general counsel of the Phœnix Bridge Company in Philadelphia, and I am here at the beginning of this inquiry, not purposing to remain here as occupying any legal professional relation particularly to this inquiry. So far as the legal relations of the company are concerned in this proceeding, they are represented by Mr. Stuart. I am here, sir, and I am moved to say what I am about to say by a remark you have just made, for the purpose of stating to the commission on behalf of the Bridge Company that it tenders its fullest and heartiest co-operation to the commission in the inquiry which is about to be made. It is our desire that the fullest investigation should be made and it is our purpose to forward that investigation to the utmost point. Next to the public interests, our interests are as great as any which can be involved in this inquiry. We will therefore, sir, be ready at all times to furnish to the commission on its request documents, records and plans which are not available by the exercise of your subpœna in this jurisdiction, and which are in our control and possession outside of this jurisdiction. We shall be subject to your directions in the production of the officers and representatives, agents and employees of the company who have knowledge of the facts which you are directed by your commission to inquire into. I feel, sir, that I need add no more to express the purpose my remarks are intended to cover.

Mr. HOLGATE.—Thank you very much, Mr. Barnes; I quite felt that that disposition would exist on the part of the Phœnix Bridge Company. I am sure that we will find that, from expressions we have heard, we will find them ready to give us that assistance. It will facilitate our work and expedite it.

Mr. W. H. DAVIDSON (Quebec).—I appear here at the request of the International Association of Bridge Workers, and the Bridge and Structural Iron Workers' Union on behalf of the victims and shall be very glad indeed to take advantage of the invitation which you have extended to the members of the bar here, to assist you in every way possible in this inquiry, and I just wish to add that I heard with a great deal of pleasure the words that have just fallen from the lips of the learned counsel of the Phœnix Bridge Company (Mr. Barnes).

Mr. HOLGATE.—If you can, in that capacity, assist in bringing before us clear evidence of fact it would certainly assist us very much.

Mr. DAVIDSON.—I can only state, sir, that any facts which are in my possession, will be, with a great deal of pleasure, placed at your disposal.

Mr. HOLGATE.—Thank you. You might submit to us the names of such witnesses as you think might be valuable in that respect.

Mr. DAVIDSON.—Certainly, sir.

Mr. ULRIC BARTHE, sworn.

Mr. HOLGATE.—You are secretary of the Quebec Bridge Company? What is the proper name of the company?

Mr. BARTHE.—I am secretary of the Quebec Bridge and Railway Company.

Mr. HOLGATE.—It is incorporated by a certain Act?

Mr. BARTHE.—I have prepared here a kind of collection of all the statutes and by-laws of the company, which will be more handy for the commissioners. (Statement put in and marked Exhibit 1.)

Mr. HOLGATE.—What do you call this—not by-laws?

Mr. BARTHE.—By-laws, statutes, and the general Railway Act which applies to the company.

Mr. HOLGATE.—What steps led to the commencement of the construction of this Quebec bridge, Mr. Barthe?

Mr. BARTHE.—Do you mean from the inception?

Mr. HOLGATE.—Yes, from its inception, in regard to its construction, I mean.

Mr. BARTHE.—It was after the company was reorganized in 1897, and after getting subsidies from the two governments at Ottawa and Quebec and the city of Quebec, and after having got $200,000 subscribed in stock, that tenders were called for the construction of the bridge in the year 1899.

Mr. HOLGATE.—Who were asked for these tenders

Mr. BARTHE.—The Quebec Bridge Company, which was its name at the time, called for tenders.

Mr. HOLGATE.—And you received tenders?

Mr. BARTHE.—Yes.

Mr. HOLGATE.—What was the next step?

Mr. BARTHE.—Then, after the tenders were reported on by the consulting engineer, Mr. Theodore Cooper, of New York, the contract was awarded, for the foundations, to Mr. M. P. Davis, and for the superstructure, to the Phœnix Bridge Company.

Mr. HOLGATE.—Were all the tenders submitted to Mr. Cooper?

Mr. BARTHE.—Yes, sir.

Mr. HOLGATE.—Were they submitted to anybody else?

Mr. BARTHE.—I do not know.

Mr. HOLGATE.—Then, was it upon Mr. Cooper's recommendation that the tender was accepted?

Mr. BARTHE.—Yes.

Mr. HOLGATE.—Which tender was accepted?

Mr. BARTHE.—As I said, for the foundation, that of Mr. M. P. Davis, and for the superstructure, that of the Phœnix Bridge Company.

Mr. HOLGATE.—I would like to know just the organization of the Quebec Bridge Company; give us your officers and what their duties are?

Mr. BARTHE.—I was not prepared to answer precisely that question this afternoon, but I put in the book there (referring to Exhibit 1) the list of the present officers as far as the head office is concerned, not concerning the engineers.

Mr. HOLGATE.—Is the engineer appointed by the board?

Mr. BARTHE.—Yes.

Mr. HOLGATE.—Who is the engineer?

Mr. BARTHE.—Mr. Hoare.

Mr. HOLGATE.—What is Mr. Hoare's title?

Mr. BARTHE.—He was always styled Chief Engineer; he was in fact the Chief Engineer.

Mr. HOLGATE.—His appointment then was by resolution of the board.

Mr. BARTHE.—Yes.

Mr. HOLGATE.—I would like to have a copy of that.

Mr. BARTHE.—It goes from the inception of the company, from the beginning of the company, before my time.

Mr. HOLGATE.—Mr. Hoare, you say, was appointed by the board of directors, so that it would be by resolution of the board?

Mr. BARTHE.—It should be.

Mr. HOLGATE.—That is what we would like to have so as to get his official appointment. I would like you to certify that the copy of that resolution is correct. And, we would like to have Mr. Hoare's duties defined, as understood by the board, if they were defined; will you let us have that to-morrow?

Mr. BARTHE.—Yes.

Mr. HOLGATE.—Were there other engineers appointed by the board besides Mr. Hoare?

Mr. BARTHE.—Mr. Theodore Cooper was appointed consulting engineer.

Mr. HOLGATE.—Is he responsible to the board?

Mr. BARTHE.—Yes—well, he was appointed by the board.

Mr. HOLGATE.—Is Mr. Hoare responsible only to the board?

Mr. BARTHE.—These are not questions which I would like to answer.

Mr. HOLGATE.—What are the relations between Mr. Cooper and Mr. Hoare?

Mr. BARTHE.—Mr. Cooper was appointed as consulting engineer. As to the exact distribution I cannot speak myself. It is a question of engineering. Mr. Hoare was appointed engineer to look after the whole work till completion.

Professor GALBRAITH.—There was no resolution giving either of these officials precedence in any way over the other as far as you know?

Mr. BARTHE.—I do not know any.

Mr. HOLGATE.—If there is anything of that nature existing, Mr. Barthe, would you look it up, and give us the corresponding information both in regard to Mr. Hoare and Mr. Cooper so as to show their relative positions?

Mr. BARTHE.—Yes.

Mr. HOLGATE.—Was there a contract existing with Mr. Cooper?

Mr. BARTHE.—There were letters exchanged which constitute a contract which was approved by the board.

Mr. HOLGATE.—Were they not brought into one document and made a contract of?

Mr. BARTHE.—No.

Mr. HOLGATE.—You might make a note also of that and let us have the letters.

Mr. BARTHE.—Yes.

Mr. HOLGATE.—Then, Mr. Cooper, you said, recommended the tender of the Phœnix Bridge Company and also the tender of Mr. Davis. What followed?

Mr. BARTHE.—The work was started.

Mr. HOLGATE.—Excuse me; what followed that? Was a contract drawn with the Phœnix Bridge Company?

Mr. BARTHE.—Yes.

Mr. HOLGATE.—I would like to see the contract.

Mr. BARTHE.—I have here a copy of the contract certified by myself. I might have produced the original but we want to keep it back after this is compared (copy of contract submitted).

Prof. GALBRAITH.—That is a certified copy?

Mr. BARTHE.—Here are the specifications (copy of specifications submitted).

Mr. HOLGATE.—That is not certified. We will not accept that.

Mr. BARTHE.—I will get another copy.

Mr. HOLGATE.—I would like if you would bring up the original contract.

Mr. BARTHE.—Well, I will bring it.

Mr. HOLGATE.—Are there specifications attached to the contract?

Mr. BARTHE.—They were not attached but they are referred to.

Mr. HOLGATE.—For the purpose of identification we must have also the original specifications—the specifications that formed part of the contract.

Mr. BARTHE.—That is in the Engineer's department.

Mr. HOLGATE.—Were not the specifications attached to the contract itself?

Mr. BARTHE.—There were no specifications attached to the contract.

Prof. GALBRAITH.—They were referred to in the contract?

Mr. BARTHE.—Yes.

Prof. GALBRAITH.—In that sense they were part of the contract?

Mr. BARTHE.—Yes, these are the specifications approved by the government engineer.

Mr. HOLGATE.—You have a copy of the specifications approved by the government engineer?

Mr. BARTHE.—We have that, but it is not in my department. I have to take these from the engineer's office.

Mr. HOLGATE.—Well, who has the official copy of the specifications?

Mr. BARTHE.—It ought to be in Mr. Hoare's office. He was governed by them.

Mr. HOLGATE.—And it is signed by the parties to the contract?

Mr. BARTHE.—I could not say. I have not seen them.

(Mr. Stuart handed in a memorandum to the commission.)

Prof. GALBRAITH.—In this last sentence you suggested that prior to the contract the plans were submitted to Mr. Cooper?

Mr. STUART.—My instructions are that the specifications were prepared and the tenders called for on the specifications before the contract was let by the Bridge Company; that they were approved before the contract was let at all.

Mr. BARTHE.—Yes, that is so.

Mr. STUART.—The succession of events is that the Bridge Company prepared specifications, upon them they called for tenders, tenders were sent in and these tenders were submitted to the engineers of the Quebec Bridge Company and approved by the engineers, Mr. Cooper and Mr. Hoare, I presume, and by the Governor in Council, before any contract was let.

Mr. BARTHE.—I wish that my deposition should be corrected in that sense. I was not as secretary—as I told you it was a question of engineering, and I had not much to do with it, but I remember now that the specifications were prepared, the tenders were called for on specifications prepared by the Quebec Bridge Company, specifications were approved by the Governor in Council.

Prof. GALBRAITH.—Any of these statements made there that you think you can swear to—(pointing to memorandum submitted by Mr. Stuart)?

Mr. BARTHE.—I do not know about this.

Prof. GALBRAITH.—You might indicate those you can swear to?

Mr. BARTHE.—And prior to a contract being awarded the plans were submitted to Mr. Cooper, and tenders were—that is, a contract was awarded on his report.

Mr. HOLGATE.—What about the order in council naming Mr. Cooper engineer on behalf of the government?

Mr. BARTHE.—I could not speak now without looking for it.

Prof. GALBRAITH.—Then we understand that Mr. Barthe says that the tenders were called for on specifications prepared by the Quebec Bridge Company? That is one statement you made?

Mr. BARTHE.—Yes.

Prof. GALBRAITH.—Then another statement is that the specifications were approved by the Governor in Council?

Mr. BARTHE.—That is the second one.

Prof. GALBRAITH.—That is another of your statements. And lastly, that prior to the contract the plans were submitted to Mr. Cooper?

Mr. BARTHE.—Yes.

Prof. GALBRAITH.—Now, what are we to understand by this other question, Mr. Stuart?

Mr. HOLGATE.—The specifications prepared by the Quebec Bridge and Railway Company?

Mr. STUART.—Yes, that is the specifications upon which the tenders were made. I think that ought to be produced. Of course that is the first step, and the foundation of the whole thing.

Prof. GALBRAITH.—We will ask you then to produce the specifications prepared by the Quebec Bridge Company. That is satisfactory, is it?

Mr. STUART.—Yes.

Mr. HOLGATE.—As well as of course the specifications under which the contract was made; also a copy of Mr. Cooper's report.

Mr. DAVIDSON.—I would like the commissioners to ask Mr. Barthe if he knows that to be an actual fact as stated in that note?

Mr. BARTHE.—What I have said, yes.

Prof. GALBRAITH.—He has said so.

Mr. DAVIDSON.—And were there any plans drawn, were there no plans made whatever? There is nothing mentioned about plans?

Prof. GALBRAITH.—We have not come to that yet, it is simply specifications.

Mr. DAVIDSON.—Oh, you have not come to plans yet.

Prof. GALBRAITH.—I think that with reference to your question referring to plans, in the course of the investigation we shall find it necessary to get into our possession at least all the plans that seem pertinent to the investigation, so I do not think it is worth while entering on that in the testimony of this witness.

Mr. DAVIDSON.—Very well, sir.

Mr. HOLGATE.—Mr. Barthe, when you make up that information you might include a copy of the circular letter that was issued inviting tenders for the construction of the bridge.

Mr. BARTHE.—I will do my best to get it.

Prof. GALBRAITH.—We simply wish a sworn statement in concise and clear language of the relations of the different parties to the contract and to the whole work, as short and clear as it can be made, the object being to have, I assume, a record which cannot be disputed as to the main relations between the parties.

Mr. HOLGATE.—Certainly.

Mr. ROY.—I am inquiring whether there would be sufficient time to have this by to-morrow because the president of the company, Mr. Parent, to my personal knowledge—and I think Mr. Barthe knows this as well—has had dealing with the engineers directly himself.

Mr. HOLGATE.—We will have the president of the company himself if necessary.

Mr. ROY.—About that statement, perhaps some facts occurred to Mr. Parent's knowledge, and not to Mr. Barthe's, so that it would not be completed by to-morrow.

Mr. STUART.—I would suggest that if Mr. Barthe prepares a statement of facts we could go over it all and satisfy ourselves after he has prepared it, and see if we can agree on a basis.

Mr. HOLGATE.—Why can you not do that?

Prof. GALBRAITH.—We can put you all on oath.

Mr. STUART.—If you like. I understood you to suggest that Mr. Barthe should prepare a statement; if he does that and submits it to Mr. Roy and myself, we would see whether we have anything to suggest or not.

Mr. HOLGATE.—It is simply a matter of history.

Mr. STUART.—That is all and it is all important to make that history absolutely accurate.

Mr. ROY.—My object was to make the statement as complete as possible and that is why I thought that there should be a little delay.

Mr. HOLGATE.—Is there any reason why we could not have that here to-morrow morning at 10 o'clock?

Mr. BARTHE.—I think myself it is rather short.

Mr. STUART.—We will try to have it to-morrow morning.

The Witness retired.

JOHN STERLING DEANS, sworn.

Mr. HOLGATE.—What is your official position?

Mr. DEANS.—Chief Engineer of the Phœnix Bridge Company.

Mr. HOLGATE.—In connection with the construction of the Quebec Bridge, would you let us have concisely a description of your organization?

Mr. DEANS.—Of the organization of the Phœnix Bridge Company?

Mr. HOLGATE.—Of the organization of the Phœnix Bridge Company with respect to the Quebec Bridge, with the names of those who have had to do with the work and their various duties or responsibilities, both in the preparation of preliminary work and designing, shop work and erection?

Mr. DEANS.—As chief engineer I have general supervision of the work of the Phœnix Bridge Company. Mr. P. L. Szlapka is the designing engineer of the company having charge of all the general designing which included the Quebec Bridge. Immediately under Mr. Szlapka is Mr. Charles Scheidal, engineer in charge detailing structure, and under Mr. Scheidal four or five assistant engineers and about 20 to 25 draughtsmen. That is the organization of the engineering office force. When you speak of shop work, it is a little hard to give that organization. I do not know exactly how you mean that.

Mr. HOLGATE.—You confine yourself there to such men as acted as inspectors of work in the shop?

Mr. DEANS.—Of course the shop work was constructed in accordance with plans and before it was shipped it was all passed upon by inspectors of the Quebec Bridge and Railway Company. Is that as much as you want about the shop?

Prof. GALBRAITH.—Have you inspectors of your own also?

Mr. DEANS.—The Phœnix Bridge Company have an inspector in our own shops.

Mr. HOLGATE.—And he would naturally inspect this material?

Mr. DEANS.—Inspect this material, and Mr. E. T. Morris——

Prof. KERRY.—Do I understand that the Phœnix Bridge Company itself constructed this material?

Mr. DEANS.—The Phœnix Iron Company of Phœnixville made all the shapes and all the smaller plates from their own open hearth steel. They bought the weightier plates from outside mills in Harrisburg and Pittsburg, but all of that material was fabricated into the complete members by the Phœnix Iron Company in Phœnixville.

Prof. KERRY.—There is a contract existing between the Iron Company and the Bridge Company?

Mr. DEANS.—Yes, there is a contract existing between the Iron Company and the Bridge Company.

Prof. KERRY.—Would that be with regard to the Quebec bridge in particular or to all work in general?

Mr. DEANS.—It is a general contract extending over a number of years beginning in 1884.

Prof. KERRY.—So that the terms of it would not be pertinent to this inquiry at all?

Mr. DEANS.—Would not be pertinent to this inquiry especially.

Prof. KERRY.—The eyebars were made where, Mr. Deans?

Mr. DEANS.—The eyebars, the material of the eyebars, was made in Harrisburg, Pa., and they were forged and tested in Phœnixville.

Mr. HOLGATE.—When your inspector goes over the material in the shop does he make it a practice for the Quebec Bridge Company inspectors to be with him, or is that inspection done independently?

Mr. DEANS.—Our inspector in the shop is inspector for all work passing through the shop. The Quebec bridge was simply an incident to his general inspection work. The Quebec bridge material was only passed as satisfactory and shipped on the inspection of the Quebec Bridge and Railway Company's inspector.

Mr. HOLGATE.—What is the name of the Quebec Bridge Company's inspector, of whom you spoke?

Mr. DEANS.—Mr. E. L. Edwards is the chief inspector, and Mr. Meeser is the assistant inspector; I do not remember his initials.

Prof. GALBRAITH.—For the Quebec Bridge Company?

Mr. DEANS.—For the Quebec Bridge Company.

Mr. HOLGATE.—They have been inspectors during the whole period of construction?

Mr. DEANS.—I think both of them have been for the entire period. I know Mr. Edwards has, the chief inspector.

Mr. HOLGATE.—Would it be possible for anything to be shipped without their inspection?

Mr. DEANS.—Absolutely not possible for anything to be shipped without their passing upon it and accepting it. Our shop discipline is such that nothing could be shipped without having been passed by the inspector of the party buying the bridge.

Prof. GALBRAITH.—Is this inspection made before or after the storage in your yards at Phœnixville?

Mr. DEANS.—The inspection is made before the storage in the yard at Phœnixville.

Mr. HOLGATE.—Then when the order is given by the Quebec Bridge Company's inspector to ship, the material is loaded by you and forwarded? When does it receive its next inspection?

Mr. DEANS.—The Quebec Bridge Company's inspector does not order the material shipped. It is shipped when we decide that it is needed for erection, but it is not shipped until they pass upon it and accept it at any time.

Prof. GALBRAITH.—But there is only one inspection made by them?

Mr. DEANS.—Only one inspection made by them at Phœnixville.

Prof. GALBRAITH.—Before the storage in the yard?

Mr. DEANS.—Before the storage in the yard.

Prof. GALBRAITH.—They do not reinspect on loading for transportation?

Mr. DEANS.—No, sir.

Prof. KERRY.—Is your general practice to store at Quebec or at Phœnixville?

Mr. DEANS.—The Quebec bridge covering such a large tonnage, a considerable portion of it has been stored at Phœnixville; at the same time the corresponding number was shipped to the south side and stored in our yard there near Chaudière.

Prof. KERRY.—You mean, for example, the member for the south and north truss would be made at the same time?

Mr. DEANS.—Would be made at the same time so as to agree exactly in the application of the templets.

Prof. KERRY.—One would be shipped to Chaudière and one would be stored at Phœnixville?

Mr. DEANS.—And is now being shipped to the Belair storage yard.

Mr. HOLGATE.—How would the inspector of the Quebec Bridge Company indicate he had passed these various pieces?

Mr. DEANS.—By a mark or notice to our inspector or to the shipper. I cannot say positively that he marked all the pieces; the usual practice is to mark every piece.

Mr. HOLGATE.—Do I understand then that there is a record of his passing each particular piece?

Mr. DEANS.—I believe the Quebec Bridge Company's representatives have a record of passing every piece of the Quebec bridge and the date it was passed?

Prof. GALBRAITH.—How is this mark made on the piece?

Mr. DEANS.—I do not remember exactly how the Quebec Company's mark is made. Some inspectors make a yellow mark and hit it with a hammer, and put their

initials on. I do not remember just exactly how they inspected it and marked it, but they have a private mark.

Mr. HOLGATE.—We can get that from Mr. Hoare.

Mr. DEANS.—You can get that from Mr. Hoare and also from the inspector.

Mr. HOLGATE.—Going back to the organization, would you now, Mr. Deans, follow the material along and describe the organization.

Mr. DEANS.—That is sufficient for the shop organization?

Mr. HOLGATE.—I think so.

Mr. DEANS.—The material then is shipped from Phœnixville and is received in the storage yard at Chaudière. There it comes in contact with the field organization of the Bridge Company. Mr. A. D. Milliken is superintendent of all our erection work and in that connection had a general supervision of the Quebec work. Immediately under him this year was Mr. D. A. Yenser, general foreman; Mr. John Worley, assistant foreman; Mr. James Aderholt, assistant foreman; Mr. Clark, assistant foreman; Mr. E. J. Wickizer, assistant foreman, and the foreman of riveters, Mr. Matthews, I think. In addition, there were two engineers kept on the work, Mr. A. D. Birks, resident engineer of erection, and Mr. F. E. Cudworth, engineer in charge of field instrument work; Mr. W. W. Waitneight and Mr. A. D. Huot, time-keeper. Is that a sufficient number?

Mr. HOLGATE.—I think so. What were the relative responsibilities of the engineers in regard to the erection and superintendence? As I understand it, you have placed them in the descending scale?

Mr. DEANS.—Yes, I have placed them in the order, I think, of their responsibility. They have entirely different duties. Mr. Cudworth's duties were to see that the bridge was kept in its proper alignment vertically, horizontally and the elevation at pin centres. His duties were entirely field instrument work.

Prof. KERRY.—Did Mr. Cudworth report to you?

Mr. DEANS.—The organization was under the general foreman, Mr. Yenser.

Prof. KERRY.—Mr. Cudworth reported to Mr. Yanser?

Mr. DEANS.—Yes, but Mr. Cudworth had the authority to insist upon certain things being so as far as his engineering judgment called for it. Mr. Cudworth, having charge of the field instruments, could tell Mr. Yenser to put a pin point at a certain elevation and Mr. Yenser would follow his instructions.

Prof. GALBRAITH.—It was his duty to follow his instructions?

Mr. DEANS.—It was his duty to follow his instructions, although Mr. Yenser is the head, or the authority on this work.

Mr. HOLGATE.—That is that Mr. Cudworth was in a position to accurately check up Mr. Yenser.

Mr. DEANS.—That is it. You can see that the general foreman of erection could hardly pass upon an engineering matter and in that connection Mr. Cudworth's authority possibly exceeded the general foreman's—or Mr. Birks'.

Prof. GALBRAITH.—Mr. Birks also exceeded his authority in that same respect.

Mr. DEANS.—In that same respect. Do I make myself clear?

Prof. GALBRAITH.—I think so. In regard to all geometrical points, Mr. Cudworth and Mr. Birks had supreme authority?

Mr. DEANS.—Yes. Mr. Birks, in addition to that——

Mr. HOLGATE.—Who would you consider the responsible man in connection with the erection of the structure?

Mr. DEANS.—I consider that Mr. Yenser was.

Mr. HOLGATE.—Acting under advice.

Mr. DEANS.—Acting under advice from these engineers.

Prof. KERRY.—Then, the exact duties of Mr. Cudworth were to indicate the physical position in which the members were to be put?

Mr. DEANS.—He gave the lines, centres and elevations and kept each in that position.

Prof. KERRY.—That was the whole of his duty?

Mr. DEANS.—That was the whole of his duty.

Mr. HOLGATE.—Will you continue then, Mr. Deans, please?

Mr. DEANS.—Mr. Birks' authority was of the same kind; that is extended to the erection features of the work; that is to see that all bolts were in position, all instructions of the office were carried out in connection with the handling of the members, the attaching of all the appliances. The traveller would not move forward until Mr. Birks said that everything was in accordance with the instructions received from the office regarding the condition of the work.

Mr. HOLGATE.—Will you be good enough to say how these instructions were given to Mr. Birks?

Mr. DEANS.—They were given to him by me—verbal, general instructions.

Mr. HOLGATE.—Are they indicated in any way on the erection diagrams?

Mr. DEANS.—I do not think they are indicated anywhere on the diagrams. Mr. Birks was placed on the work especially to see that all the minute instructions of the office in connection with the erection of the work, piece by piece, and the moving of the traveller ahead were carried out independent of the foreman.

Prof. GALBRAITH.—In whose hands were the instructions that you now speak of—the written instructions—finally placed?

Mr. DEANS.—These written instructions were placed in the hands——

Prof. GALBRAITH.—You might as well say from whom they went?

Mr. DEANS.—They were sent to Mr. Yenser from the office, and he handed a copy to each one of the under-foremen.

Prof. GALBRAITH.—He made copies of them?

Mr. DEANS.—They are blue prints. These instructions I speak of are blue prints in a small book supplied to the foremen in addition to the instructions which are especially put on the detailed plans which you will see.

Prof. KERRY.—They were sent to Mr. Yenser

Mr. DEANS.—A sufficient number of copies were sent to Mr. Yenser to furnish copies for all our foremen, assistant foremen, engineers and the chief engineer and representatives of the Quebec Bridge Company.

Mr. HOLGATE.—Would it be the ordinary course for him to give a copy of them to Mr. Birks?

Mr. DEANS.—I know that Mr. Birks had a copy personally.

Mr. HOLGATE.—From Mr. Yenser?

Mr. DEANS.—From Mr. Yenser.

Mr. HOLGATE.—And Mr. Birks had to see that Mr. Yenser carried them out?

Mr. DEANS.—Mr. Yenser would carry them out if nothing occurred, but we considered that it was necessary to have a special check from an engineering standpoint.

Mr. HOLGATE.—There were no special instructions to Mr. Birks to see that these instructions were carried out?

Mr. DEANS.—Our instructions were through the general foremen.

Prof. KERRY.—There were practically three responsible heads then, Mr. Deans: Mr. Yenser, the gentleman responsible for the erection and conduct of the work, Mr. Birks, responsible for the close inspection, to see that the company's instructions were carried out, and Mr. Cudworth, responsible for seeing that the members were put in their correct positions?

Mr. DEANS.—Yes, you might call it three responsibilities, all under Mr. Yenser, our general foreman.

Prof. KERRY.—Did such a thing as a conflict of authority between these different heads, or anything of that sort, ever arise; any difference as to the way a thing should be done?

Mr. DEANS.—Nothing that ever reached my ears in the Phœnixville office.

Prof. GALBRAITH.—Was the chance of such a conflict avoided by these officers having instructions from you that in case of a disagreement between them Mr.

Yenser had the final decision? Although this never occurred to your knowledge, was there any care taken to make it absolutely certain who had the authority in case of a disagreement?

Mr. DEANS.—It was made very clear to all concerned on the Quebec bridge that the final man in authority was Mr. Yenser, through the superintendent of erection, but I cannot imagine Mr. Yenser going contrary to the absolute instructions of either of the engineers.

Mr. HOLGATE.—We would like you to prepare a short memorandum, Mr. Deans, of the records of Mr. Yenser and of Mr. Birks.

Mr. DEANS.—Of their records?

Mr. HOLGATE.—Yes, indicating their experience, and your reasons for appointing them.

Mr. DEANS.—I will be very glad to do that, sir.

Mr. HOLGATE.—Mr. Cudworth can answer for himself.

Mr. DEANS.—He is here.

Prof. KERRY.—Were the selections in each case made by you personally, Mr. Deans?

Mr. DEANS.—The engineers were selected by me and the field men were selected by our superintendent of erection, Mr. Milliken, who always acted with respect to the principal men in conference with me.

Mr. GALBRAITH.—What was the relation between Mr. Milliken and Mr. Yenser with regard to the Quebec Bridge?

Mr. DEANS.—During the erection of the work Mr. Milliken spent a large portion of his time on the work and when he was present he was in supreme authority.

Mr. HOLGATE.—Was Mr. Yenser in the same position during the whole of the time on the portion that was being erected from the beginning of the work?

Mr. DEANS.—No, Mr. Yenser has been foreman—this will be the second year, but he was foreman in usual charge all the time he was on the Quebec work.

Mr. HOLGATE.—Was there any other foreman in charge of the erection of the work besides Mr. Yenser?

Mr. DEANS.—Mr. Shoemaker was in charge the first year during the erection of three panels of the lower chords, shoes and anchor span.

Mr. HOLGATE.—Is he still with you?

Mr. DEANS.—No, sir.

Prof. KERRY.—That would be the work of 1905?

Mr. DEANS.—The work of 1905.

Mr. HOLGATE.—And Mr. Yenser took the work up from there?

Mr. DEANS.—From there.

Mr. HOLGATE.—So that the chief charge of the work has been with Mr. Shoemaker and Mr. Yenser?

Mr. DEANS.—During the erection of the metal.

Mr. HOLGATE.—What about the engineers in the same way?

Mr. DEANS.—The same engineers have been on the work all the time.

Mr. HOLGATE.—No change has been made in the engineers?

Mr. DEANS.—No change has been made in the engineers.

Prof. GALBRAITH.—Either in the office or resident?

Mr. DEANS.—No.

Mr. HOLGATE.—I was referring only to the erection.

Mr. DEANS.—I supposed you meant only the erection. No change has been made in the erection engineers.

Prof. KERRY.—In cases of emergency the power to act lay either with Mr. Yenser or Mr. Milliken if he was there?

Mr. DEANS.—Finally.

Prof. KERRY.—They would be the men whose duty it would be to see what should be done?

Mr. DEANS.—Yes, that is right.

Prof. KERRY.—To what extent did they have any instructions from headquarters in connection with emergencies?

Mr. DEANS.—They had no special instructions to my recollection.

Prof. KERRY.—Their power was unlimited in case their judgment called for extraordinary action?

Mr. DEANS.—Yes, you may say their power was unlimited, but I should expect them to refer to the office if they had any serious question arise.

Mr. HOLGATE.—Were the instructions which were given through the erection plans to the foreman absolute?

Mr. DEANS.—The instructions on the plans and blue prints I referred to, could not be departed from without instructions from the office.

Mr. HOLGATE.—So that they were definite enough to entirely guide the erector?

Mr. DEANS.—They sufficed for the erection of nearly half the bridge.

Mr. HOLGATE.—Did he have to have these supplemented from time to time?

Mr. DEANS.—The only changes that I know of in these instructions were just slight changes of operation which we thought would save a little time or expense on the north side.

Prof. GALBRAITH.—By whom were these supplementary instructions given? Were they given from the office?

Mr. DEANS.—Suggestions reached us from Mr. Birks that on the north side we might make a little change but they were not carried out without our advice.

Mr. HOLGATE.—Did these suggestions arise from the experience they had gained on the south shore?

Mr. DEANS.—They were of very minor importance of themselves and arose from their experience in handling the work. They are all of very minor importance and are all noted on the print.

Mr. HOLGATE.—So that the bridge was erected from the detailed instructions issued from the Engineers' office at Phœnixville.

Mr. DEANS.—Yes, that is a fair statement of the fact. The instructions as to how the bridge should be erected were prepared in Phœnixville and carried out by the foreman in the field.

Prof. GALBRAITH.—And these alterations that you spoke of that were recorded on the instructions were from Phœnixville, were they?

Mr. DEANS.—No, they were from the field because they grew out of the experience in the field, reported in Phœnixville, and then incorporated on our blue prints for use on the north side.

Prof. GALBRAITH.—At Phœnixville?

Mr. DEANS.—At Phœnixville.

Prof. GALBRAITH.—Yes. The incorporation was done at Phœnixville and they were forwarded here?

Mr. DEANS.—When there were any changes made on the south side?

Prof. GALBRAITH.—Yes?

Mr. DEANS.—Yes, sir.

Mr. HOLGATE.—In connection with these instructions that would be issued in this way, Mr. Deans, was Mr. Milliken consulted?

Mr. DEANS.—Yes, sir—his department.

Mr. HOLGATE.—His department was consulted?

Mr. DEANS.—Yes, sir.

Mr. HOLGATE.—So that it was a committee of engineers that studied the matter and agreed on a certain method of erection?

Mr. DEANS.—Engineers and erectors—the erecting department.

Mr. HOLGATE.—Agreed upon a certain method of erection and then that method was set out on the blue print?

Mr. DEANS.—On the plans and blue prints.

Mr. HOLGATE.—And the erection foreman was governed by these instructions and no others?

Mr. DEANS.—Absolutely.

Mr. HOLGATE.—Is that your usual method of procedure in the office?

Mr. DEANS.—That is a very unusual method.

Mr. HOLGATE.—Adopted in this case, why?

Mr. DEANS.—It was adopted in this case as an extra safeguard against allowing the foreman to use his judgment in regard to the handling of material, and to fix that method by the best experience we had in our company.

Mr. HOLGATE.—Did you have to go outside of your own organization for consulting advice in this matter?

Mr. DEANS.—We did not. We had the benefit of all our plans being passed upon by Mr. Theodore Cooper for the Quebec Bridge Company.

Mr. HOLGATE.—Otherwise, your organization was, in your opinion, fully competent to deal with the matter?

Mr. DEANS.—We considered that we were fully competent to deal with the matter.

Mr. HOLGATE.—Then, as to your relations with Mr. Cooper, was it a continuous communication with him on these points?

Mr. DEANS.—Our relation with Mr. Cooper has been continuous since he was first appointed.

Mr. HOLGATE.—And were the plans that you worked to approved by Mr. Cooper?

Mr. DEANS.—All the plans that were worked to were approved by Mr. Cooper.

Prof. GALBRAITH.—Had Mr. Cooper any say in the matter of erection?

Mr. DEANS.—Mr. Cooper was particularly represented on the erection by Mr. McLure, an employee of the Quebec Bridge Company, who was selected to represent him in the field by Mr. Cooper.

Mr. HOLGATE.—Mr. Deans, would you just go back to those diagrams for the erection again? Are they approved by anybody outside of the Phœnix Bridge Company—the method of erection? You were just speaking of the detailed instructions?

Mr. DEANS.—No, they are not signed by anybody else.

Mr. HOLGATE.—They are simply instructions issued from the shop?

Mr. DEANS.—From the office.

Mr. HOLGATE.—From the office. They are not part of the set of plans of the bridge?

Mr. DEANS.—They were simply our instructions to carry out the work which was passed upon and approved by Mr. Cooper for the carrying out of the details of construction.

Mr. HOLGATE.—But these instructions were not put before the Quebec Bridge Company for approval?

Mr. DEANS.—No.

Prof. GALBRAITH.—And not before Mr. Cooper?

Mr. DEANS.—Not before Mr. Cooper.

Mr. HOLGATE.—So that the question of erection then was your own question?

Mr. DEANS.—That was our own question.

Prof. KERRY.—Are there any general written instructions, Mr. Deans, to the various officers? As I understand it, there are special blue print instructions stating how certain members shall be put up; are there in addition, general instructions to each of the senior officers with regard to the conduct of his work?

Mr. DEANS.—No, sir.

Prof. KERRY.—And what regular reports are there with regard to the progress of the work?

Mr. DEANS.—Every day we had a report from our general foreman giving the progress of the work.

Prof. KERRY.—And also reports from the engineers or just——

Mr. DEANS.—No, the reports came through the general foreman.

Prof. KERRY.—The report of the positions and the report of the inspection and the report of progress was in the daily report made by the general foreman, and that was the only report made to the office?

Mr. DEANS.—That is correct.

Prof. KERRY.—These reports are all on file, Mr. Deans, I presume?

Mr. DEANS.—Those reports are on file.

Mr. HOLGATE.—Are there copies here?

Mr. DEANS.—The copies must be here; the originals, of course, are in Phœnixville.

Mr. HOLGATE.—In whose charge are those copies?

Mr. DEANS.—In charge of Mr. Milliken, our superintendent of erection.

Mr. HOLGATE.—We think it would be an advantage to us to adjourn until to-morrow morning at 10 o'clock in order to give Mr. Barthe and Mr. Hoare together an opportunity to get that matter straightened up before we go any farther, and if Mr. Davidson will have that memorandum of those witnesses——

Mr. DAVIDSON.—I shall do my very best to have it for to-morrow morning.

Mr. HOLGATE.—If you could keep in mind what we said a while ago, that it is only men who can give evidence of fact——

Mr. DAVIDSON.—I do not presume to bring men here to express engineering opinions.

Mr. HOLGATE.—I do not mean that, but hearsay evidence or anything of the kind—

Mr. DAVIDSON.—Not at all.

Mr. HOLGATE.—We want to keep as close to the line of direct evidence as we can.

Mr. DAVIDSON.—I quite understand that, sir, and we will endeavour to do right.

The commission adjourned until 10 o'clock to-morrow (Tuesday) morning.

SECOND DAY.

QUEBEC, P.Q., September 10, 1907.

ULRIC BARTHE, Secretary Quebec Bridge Company, recalled.

Mr. HOLGATE.—Were you able to get all the information together?

Mr. BARTHE.—I regret to say not everything.

The witness retired.

JOHN STERLING DEANS, Chief Engineer, Phœnix Bridge Company, recalled.

Mr. HOLGATE.—Mr. Deans, who had power to dismiss Mr. Yenser or Mr. Cudworth, or Mr. Birks?

Mr. DEANS.—Mr. A. B. Milliken could have dismissed Mr. Yenser and could have requested the removal of Mr. Birks or Mr. Cudworth from me and his request would have been conceded.

Mr. HOLGATE.—There was no person on the bridge continually who could have exercised that power?

Mr. DEANS.—Naturally there would be nobody there continuously who could discharge Mr. Yenser, because he was in supreme authority.

Mr. HOLGATE.—But he could not have exercised that power with regard to the others?

Mr. DEANS.—He could have requested their removal from the Phœnixville office.

Mr. HOLGATE.—Have you got plans of the two travellers that were used?

Mr. DEANS.—They are in Quebec, in our office in Quebec at the bridge.

Mr. HOLGATE.—At the bridge? Will you please have them sent here?

Mr. DEANS.—Yes, sir, together with all erection plans.

Mr. HOLGATE.—Yes, together with all erection plans.

Mr. DEANS.—You asked yesterday about them.

Mr. HOLGATE.—And who is the proper party to explain those plans, would it be yourself?

Mr. DEANS.—I could explain the plans, yes.

Mr. HOLGATE.—Could Mr. Milliken?

Mr. DEANS.—Yes, sir.

Mr. HOLGATE.—I think you said yesterday that the construction plans were not submitted to Mr. Cooper?

Mr. DEANS.—The erection plans?

Mr. HOLGATE.—The erection plans.

Mr. DEANS.—I cannot say that they were not presented to Mr. Cooper, but they were not presented to him in the sense of getting his approval on every detail of them. If he had any comments to make he was in a position to make them.

Prof. GALBRAITH.—Oh, so that these erection blue prints were shown to Mr. Cooper for comments if he considered it necessary, while at the same time you were the supreme authority in deciding whether they were to be used or not. That is to say, Mr. Cooper could only advise; he had only advisory functions in connection with them. Is that the case?

Mr. DEANS.—I do not think that is a too strong statement of the facts; but further, Mr. Cooper, being in supreme authority, could have stopped or interfered with the erection through Mr. Hoare at any time that he saw fit.

Prof. GALBRAITH.—When you said yesterday that these plans were simply a part of the Phœnix Company's business, and that Mr. Cooper had no responsibility in connection therewith, you meant that to be simply in general; while at the same time, as you have said now, he could stop the work and stop anything that he pleased through Mr. Hoare?

Mr. DEANS.—Absolutely.

Prof. GALBRAITH.—That is the position?

Mr. DEANS.—That is the position.

Prof. KERRY.—Specifically, Mr. Deans, the plans of the travellers were regarded entirely as part of the erection plant, and did not require and did not have approval by anybody outside the Phœnix Bridge Company?

Mr. DEANS.—Nothing except a general approval; no signed documents, no signed papers.

Prof. GALBRAITH.—From Mr. Cooper?

Mr. DEANS.—From Mr. Cooper.

Prof. GALBRAITH.—The plans of the travellers were treated then just as all the other ordinary erection blue prints; they were not considered especially by Mr. Cooper?

Mr. DEANS.—No, the plans of the travellers were not considered especially by Mr. Cooper any more than any other feature of the erection or construction of the plant.

Prof. KERRY.—Was it the regular practice to submit all these plans bearing on the erection plant and the erection detail to Mr. Cooper?

Mr. DEANS.—Only in the sense of keeping him posted as to the general plan of our erection and procedure.

Prof. KERRY.—But in general, would all the plans appear before him or not, or would all the important plans appear before him?

Mr. DEANS.—I think Mr. Cooper saw all the important plans of erection.

Mr. HOLGATE.—Mr. Deans, were the erection blue prints simply detail working

plans of the general plan approved by Mr. Cooper, and contained nothing of plan or design not covered by the general plans?

Mr. DEANS.—In answering that question, the erection blue prints did not affect any plan or design covered by the approval of Mr. Cooper, either of the general plans or of the details.

Mr. HOLGATE.—What understanding had you, Mr. Deans, of the status of Mr. Hoare, first, and of Mr. Cooper in regard to the carrying out of the contract between the Quebec Bridge Company and the Phœnix Bridge Company?

Prof. GALBRAITH.—You mean Mr. Deans' personal interpretation of their functions?

Mr. HOLGATE.—Yes?

Mr. DEANS.—I understood that Mr. Cooper had supreme authority in connection with the interpretation of the specifications, had authority to change them from time to time as he saw fit, and had authority to approve all of our general and detailed plans.

Mr. HOLGATE.—Was that power exercised in regard to the approval of all?

Mr. DEANS.—That power was exercised by Mr. Cooper throughout the contract.

Mr. HOLGATE.—Were any plans used where that power of Mr. Cooper's was not exercised?

Mr. DEANS.—No plans were used where that power of approval of Mr. Cooper was not exercised.

Prof. KERRY.—The specifications formed part of the contract, Mr. Deans. Was your understanding that the power was vested in Mr. Cooper to alter these specifications?

Mr. DEANS.—Yes, sir, we had notice that Mr. Cooper had authority to alter those specifications; we also had notice that his authority and approval of plans would be considered final.

Prof. GALBRAITH.—In what form was his approval conveyed to you, in writing?

Mr. DEANS.—He had a rubber date stamp and he wrote on each drawing 'examined and approved by Theodore Cooper, Consulting Engineer, Quebec Bridge and Railway Company.'

Prof. GALBRAITH.—I think you said that you had notice from the company that Mr. Cooper had power to alter or amend the specifications.

Mr. DEANS.—We had.

Prof. GALBRAITH.—That would be in writing.

Mr. DEANS.—That was in writing and one of the papers which we asked Mr. Barthe to submit to you.

Prof. GALBRAITH.—You have the communications that passed?

Mr. DEANS.—We have the copy in Phœnixville.

Prof. GALBRAITH.—You could let us have that?

Mr. DEANS.—In addition to the originals?

Prof. GALBRAITH.—Oh, well, if it is identified here it is all the same.

Mr. DEANS.—We can let you have our copy.

Prof. KERRY.—The original would be quite sufficient. Also did you ask Mr. Barthe to produce the statement with regard to Mr. Cooper's authority; is that among the papers produced?

Mr. DEANS.—I do not think it was.

Mr. STUART.—I think that is in the Order in Council.

Mr. DEANS.—That Order in Council is the authority I referred to as the power to change the specification. He had the government order in council giving him authority to change the specification.

Mr. HOLGATE.—What is there to show that Mr. Cooper's power was final?

Mr. DEANS.—I think that paper of order in council would indicate that.

Prof. GALBRAITH.—In whose possession is that order in council?

Mr. DEANS.—It must be in Mr. Hoare's, or the Quebec Bridge and Railway Company's. We have a copy.

Prof. KERRY.—Mr. Deans, can you recall if Mr. Cooper at any time subsequent to the signing of the contract exercised his power to alter specifications?

Mr. DEANS.—He altered them in several, or in many instances.

Prof. KERRY.—Your understanding of the duties and powers of Mr. Cooper and Mr. Hoare, is entirely based on written documents?

Mr. DEANS.—I think my conclusions can all be shown by written documents.

Prof. KERRY.—That is the whole point.

Mr. DEANS.—I think so.

Mr. HOLGATE.—Now with regard to Mr. Hoare, Mr. Deans?

Mr. DEANS.—Regarding Mr. Hoare's authority?

Mr. HOLGATE.—Yes, sir, as you understood Mr. Hoare's position in relation to the contract.

Mr. DEANS.—Mr. Hoare being the chief engineer of the Quebec Bridge and Railway Company, I understood that I should look to him for any final instructions in connection with the contract in its execution.

Mr. HOLGATE.—Of what nature?

Mr. DEANS.—Well, I should say in all matters outside of the approval of plans and the interpretation of the specification and should look to him for final instructions in connection with the work in the field or shop.

Prof. GALBRAITH.—In other words, you assumed that he had the power to stop any piece of work?

Mr. DEANS.—That expresses it.

Prof. GALBRAITH.—To reject any piece of work.

Mr. DEANS.—That expresses it.

Prof. KERRY.—Or to express that in another way your understanding would be that with the exception of the preparation of the specifications and the approval of the detail plans that the entire final responsibility for the construction of the bridge lay with Mr. Hoare?

Mr. DEANS.—I do not think that is expressing it too broadly.

Prof. GALBRAITH.—Mr. Deans, if Mr. Cooper should have given instructions to stop the work at any stage what would you have considered it your duty to do?

Mr. DEANS.—I should have felt it incumbent to notify Mr. Hoare and receive his instructions.

Mr. HOLGATE.—Were changes in specifications made by Mr. Cooper communicated in writing, in duplicate and filed with both parties?

Mr. DEANS.—We receive a typewritten copy of the changes which he instructed us to make and I assume that a copy of these was left with Mr. Hoare.

Mr. HOLGATE.—You have your copy?

Mr. DEANS.—We have our copy in Phœnixville; if you cannot get the copy I will furnish you ours.

Mr. HOLGATE.—Yesterday we asked you for the records of Mr. Yenser and Mr. Birks.

Mr. DEANS.—Their professional records.

Mr. HOLGATE.—Their professional records; we would like you to give that just in your own way.

Mr. DEANS.—I think I had better read it because I will interline one or two things; it is just short. Mr. B. A. Yenser, general foreman, was about 38 years of age. Mr. Yenser had worked for several other bridge companies before entering the service of the Phœnix Bridge Company and he had been in the employ of the Phœnix Bridge Company for about 15 years. For about 10 years of this time he had acted as general foreman of erection, and he had charge of some of the most important structures built by the company, viz.: Elevated Railway, Brooklyn, N.Y.; Cambridge Bridge, Boston, Mass.; El Paso Bridge, Texas; Tennessee River Bridge, Tennessee; Susquehanna River Bridge, Towanda, &c.

Having shown unsual qualities as an erector, being extremely careful and conscientious, and having had large experience in the handling of men, he was selected for the Quebec work, where he had been in charge during the seasons of 1906 and 1907.

Mr. A. H. Birks, resident engineer of erection was about 28 years old. He was highly recommended to the company by Prof. George F. Swan, professor of civil engineering of the Massachusetts Institute of Technology, Boston, as one of his most promising graduates. He was a post-graduate of this institution. He entered the employ of the Phœnix Bridge Company about six years ago. His first duties were as a structural draughtsman. It was soon found that he was a man of unusual ability and high character and he was soon transferred to the erection department as assistant engineer. In this department, when the Quebec erection plans were taken up, he worked out many of the details of erection in connection with the heads of this department. He was at work on these plans and details about two and a half to three years; thus being familiar with all the department plans and details of erection, he was put on the Quebec work and worked in absolute harmony with the general foreman, and assistant foremen, having the confidence and respect of every man.

Mr. HOLGATE.—Then this was the first field work that Mr. Birks had undertaken?

Mr. DEANS.—No, Mr. Birks had been on several of our field erections before this.

Prof. KERRY.—Could you specify those, Mr. Deans?

Mr. DEANS.—I could not specify that off hand; I can get that later on and give it to you.

Prof. KERRY.—If you would, please.

Mr. DEANS.—I shall.

Mr. HOLGATE.—I wish you would give us an idea of how these men worked together on that bridge. What I mean is was there confidence mutually all around and did these men work in harmony?

Mr. DEANS.—We frequently commended on the very unusual harmony existing between the force on the Quebec Bridge. There was absolute harmony of action between the engineers, the foreman and assistant foremen. There was not a single bit of friction between them that has come to my knowledge since the work started and I believe that each had the other's confidence to the fullest extent.

Mr. HOLGATE.—Did that harmony extend also between themselves and the representatives of the Quebec Bridge Company on the ground?

Mr. DEANS.—I believe it extended through the entire force of the Quebec Bridge and Railway Company on the ground, their representatives there.

Prof. KERRY.—The situation would be, Mr. Deans, that Mr. Birks was practically a technical advisor to Mr. Yenser, in all matters involving purely technical knowledge.

Mr. DEANS.—Mr. Birks was an adviser to Mr. Yenser in technical matters, as far as they referred to the erection and the appliances for handling the erection.

Prof. GALBRAITH.—Mr. Birks gave no orders to foremen?

Mr. DEANS.—He gave no orders to anybody.

Prof. KERRY.—Mr. Yenser was what would be known as an erection man, in no way an engineer.

Mr. DEANS.—That is correct. I would like to add to my testimony of yesterday in two or three particulars. All of the material, after it was constructed in the shop and passed by the inspector, was marked 'the property of the Quebec Bridge and Railway Company,' by a stencil stamp, white leaded.

Prof. GALBRAITH.—That is that it was painted on.

Mr. DEANS.—A stencil and painted on.

Prof. GALBRAITH.—Not indented or stamped into the metal in any way.

Mr. DEANS.—No, not that. I was not familiar yesterday as to the inspector's stamp passing this material; you asked me that question?

Prof. GALBRAITH.—Yes.

Mr. DEANS.—I find that the inspector's stamp——

Prof. GALBRAITH.—Which inspector?

Mr. DEANS.—The Quebec Bridge Company's inspector. When he had examined the material and passed upon it, as correct and constructed in accordance with the plans and specifications at the shop, there was a white or yellow 'Q' painted on the metal and inside of this 'Q' a stencil stamp was indented in the metal marked 'Q-B' and every piece in the bridge passed and inspected had that 'Q-B' indented in it. It was 'Q-B' stamped on the end of a hammer and the inspector striking the metal a blow indented the stamp in the steel making it a mark that could not be removed.

You also asked me the question whether there was any inspection after the material had been examined and accepted at the shops before shipment. The contract provided that at any stage of construction inspection should take place, and in case of any injury to material in transit or handling that inspection would be exercised before the structure was put in the bridge. Yesterday I believe I said there was no further inspection.

Mr. HOLGATE.—Was the inspection as called for under the contract fully carried out?

Mr. DEANS.—As far as I know it was carried out in all respects.

Mr. HOLGATE.—There is nothing else you would like to add? You might say who if it is within your knowledge, made the inspection on the ground here?

Mr. DEANS.—I think the inspection on the ground here would have been made by Mr. Kinloch or Mr. McClure or Mr. E. A. Hoare.

Prof. GALBRAITH.—In general that inspection was made where, at the yard before the material was stored, before the storing took place, or also at the bridge?

Mr. DEANS.—The inspection would be made at any point where any changes were made in members after the members had been inspected and passed at the shops. In other words, if we altered a member in any particular after it was inspected and stamped we expected that it would have another inspection before we could put that member in place.

Mr. GALBRAITH.—Or if any accident happened or if any alteration occurred in any way?

Mr. DEANS.—If we altered it in any way after it was inspected and stamped at Phœnixville, we looked for and asked for an inspection before we put that member in place.

Mr. HOLGATE.—Was it to your interest to have inspections made as often and as thoroughly as possible?

Mr. DEANS.—Certainly.

Prof. KERRY.—In general you had two regular inspections, one at the shop, and one on the bridge just before the material was erected, did you not?

Mr. DEANS.—I do not wish to convey a wrong impression. There were no two general inspections. Of course, if the inspectors here would notice anything that was overlooked in the shop they would call our attention to it, but I wish it understood that if any member, once passed and stamped at Phœnixville, was altered in any particular by us we asked for and expected another inspection before we put it in the work.

Prof. KERRY.—There was no regular, systematic re-inspection of material before it went into place?

Mr. DEANS.—Not as I understand it.

Prof. GALBRAITH.—You said yesterday, I think, that there were parts of the structure not rolled in the Phœnixville mills that you obtained from Pittsburg and Harrisburg, that these portions were larger portions than you could manufacture in your own shops?

Mr. DEANS.—In plates?

Mr. GALBRAITH.—In plates. Had you, or had the Quebec Bridge Company.

inspectors who examined these plates during the process of construction, or at any time before they were delivered to you at Phœnixville?

Mr. DEANS.—All the material manufactured at outside mills was tested, examined and passed by an inspector of the Quebec Bridge Company before it was shipped to Phœnixville and fabricated.

Prof. GALBRAITH.—If there are any points which you think we have missed and wish to bring out, it might be as well for you to do so—in this connection?

Mr. DEANS.—I thought over it last evening and the three I mentioned were the only three I thought of at the time.

Prof. KERRY.—Was there any regular inspection at or near the bridge previous to the erection of all members by the officers of the Phœnix Bridge Company?

Mr. DEANS.—They exercised a careful inspection of the work at the bridge and in the yards.

Prof. KERRY.—A systematic inspection?

Mr. DEANS.—A systematic inspection as each member was passed out to the bridge to see that it was all right?

Prof. GALBRAITH.—Could you describe the nature of the inspection? Was it visual entirely, or did they use tools, or put lines on the material, or anything of that kind? Could you give any idea of the nature of the inspection?

Mr. DEANS.—The nature of the inspection was a careful examination of each member at the time it was being prepared for erection and appliances attached for handling the same.

Prof. GALBRAITH.—Was there anything other than a purely examining by eye? Was there anything done by the hand or anything of that kind? Perhaps I can get this information better from another witness.

Mr. DEANS.—Possibly.

Mr. HOLGATE.—Who would that be, Mr. Deans?

Mr. DEANS.—I think possibly Mr. Kinloch or Mr. McLure of the Quebec Bridge Company. Our own men that did that work, you know, were lost in the disaster. Mr. A. B. Milliken might be able to give you the information.

Mr. HOLGATE.—In the carrying out of the inspection that you have just been describing, if any error or defect were found, whose duty would it be to report it and to whom would the report be sent?

Mr. DEANS.—It would be the duty of anybody who noticed any defect to report it and it would be reported to Mr. Yenser.

Prof. GALBRAITH.—Mr. Kerry says that he really means who were the individual inspectors who reported these things.

Mr. DEANS.—Any defect in any member in the yards or previous to erection would have been more likely to have been found by Mr. Birks as he was the one to see that the member with all its attachments was in proper shape to be erected and he would have reported any defect to Mr. Yenser.

Prof. KERRY.—In case of defects developing on the bridge that were not observed previous to erection was there any systematic inspection of the members that had already been erected from time to time?

Mr. DEANS.—I should say that the inspection was systematic to the extent that all of the bridge was under close observation all the time.

Prof. KERRY.—More particularly from Mr. Yenser and Mr. Birks?

Mr. DEANS.—From our side more particularly by Mr. Birks and Mr. Yenser.

Prof. GALBRAITH.—Was Mr. Milliken much on the bridge?

Mr. DEANS.—He was on the bridge the greater part of the time during the construction season.

Mr. HOLGATE.—I think you said, Mr. Deans, that defects found would be reported to Mr. Yenser?

Mr. DEANS.—Yes, sir.

Mr. HOLGATE.—Would he then act on his own discretion or would he ask for advice from the head office in Phœnixville?

Mr. DEANS.—In minor matters he would act on his own responsibility in connection with Mr. Birks and his other assistants.

Prof. GALBRAITH.—That is to say, that he would confer with them before deciding?

Mr. DEANS.—He would confer with them before deciding.

Mr. HOLGATE.—As to whether it was a minor or greater matter would be left to Mr. Yenser's discretion?

Mr. DEANS.—I should not say that altogether. It would be decided at the conference between Mr. Yenser and the engineers and as they worked in entire harmony it would be the general conclusion of all.

Mr. HOLGATE.—That is what I mean, represented by Mr. Yenser who was in charge.

Mr. DEANS.—That is right.

Mr. HOLGATE.—It is not likely that Mr. Yenser would, on his own responsibility, decide without conference with Mr. Birks?

Mr. DEANS.—Not at all; it was not possible.

Mr. HOLGATE.—In any question of that nature that arose between Mr. Yenser and Mr. Birks where they had discussions in matters of that kind would they include such in their periodical reports to the office?

Mr. DEANS.—Anything they had considered important.

Prof. KERRY.—Do you mean, Mr. Deans, that they would come to a decision and that they would then report to the office that such circumstances had arisen and that they had decided to act in such a way?

Mr. DEANS.—I feel that we had a complete report of that kind.

Witness retired.

FRANK CUDWORTH sworn.

Witness retired.

A. B. MILLIKEN, sworn.

Mr. HOLGATE.—Mr. Milliken, will you please describe your position and your duties?

Mr. MILLIKEN.—My position is superintendent of erection—general erection. My duties, in a general way, are to appoint foremen and arrange for the different forces in the different parts of the country for our work.

Mr. HOLGATE.—Have you charge of the erection of all the Phœnix Bridge Company's works?

Mr. MILLIKEN—Yes, in the United States and Canada.

Mr. HOLGATE.—How long have you occupied that position?

Mr. MILLIKEN.—Seventeen years.

Mr. HOLGATE.—By whom were you appointed?

Mr. MILLIKEN.—By our chief engineer, Mr. Deans.

Mr. HOLGATE.—Are your instructions in writing from the company?

Mr. MILLIKEN.—Well, sometimes they are; yes, sir.

Mr. HOLGATE.—General instructions, I mean, of appointment?

Mr. MILLIKEN.—Not as a rule. Oh, of appointment?

Prof. GALBRAITH.—The general instructions of appointment—are they printed or in writing?

Mr. MILLIKEN.—It was in writing.

Mr. HOLGATE.—To whom are you responsible?

Mr. MILLIKEN.—To Mr. Deans.

Mr. HOLGATE.—To what extent is that responsibility?

Mr. MILLIKEN.—I report directly to him and take instructions from him.

Mr. HOLGATE.—What other works, besides the Quebec bridge, have you had under your charge since the commencement of the construction of the Quebec bridge?

Mr. MILLIKEN.—I could not enumerate them just now, but I can give them to you. There is a very great number of them.

Mr. HOLGATE.—Just name some of them.

Mr. MILLIKEN.—There are bridges for the Southern Railway and the Lehigh Valley Railway.

Mr. HOLGATE.—Just mention the different ones.

Mr. MILLIKEN.—The Cambridge bridge at Boston. The Tennessee River bridge in Tennessee, the bridge crosses the Susquehanna river for the Lehigh Valley railway in Pennsylvania.

Mr. HOLGATE.—Do I understand that these were all going on at the same time as the Quebec bridge construction?

Mr. MILLIKEN.—Yes, and a great many more, not so large as that, though.

Mr. HOLGATE.—Prior to the construction of the Quebec bridge what large works had you in hand as superintendent?

Mr. MILLIKEN.—The Pecos viaduct in Texas, the Missouri river bridge at Omaha, and the Missouri river bridge at Sioux city, Iowa.

Prof. KERRY.—It would be well to say which bridge in each case.

Prof. GALBRAITH.—Specify the bridge if there is more than one.

Prof. KERRY.—There is more than one Missouri river bridge at Omaha, for example.

Mr. MILLIKEN.—I do not remember the name of the road but I know what the spans consist of—two 500 fixed spans and two 490 feet draw spans. The bridge at Omaha was a 520 foot double track draw bridge. The bridge at Towanda, Pa., consisted of 14 spans, double track, 130 foot deck plate girders. The Pecos viaduct consisted of the viaduct with cantilever spans in the centre of it 328 feet high. The Cambridge bridge consisted of 8 or 9 arch spans; the dimensions I do not remember. The Tennessee river bridge at Lowden, Tenn., consisted of eight 150 foot spans or 300 foot spans. A great many of these structures of course, were renewal and maintained traffic.

Mr. HOLGATE.—You mention that some of them were renewal,—why?

Mr. MILLIKEN.—I mention the maintaining of traffic because we had to take care of all trains, both passenger and freight, with safe passage during erection or renewal. There is also the bridge for the Grand Trunk railway at Belœil. I forgot two very large structures, one for the United States government crossing the Mississippi river at Rock Island; also another one across the same river about a mile below this government bridge, both of them very large structures, on one of which, a double decked bridge, we had to maintain both roadway and railway traffic.

Mr. HOLGATE.—What is the largest work on the cantilever principle that you have had charge of?

Mr. MILLIKEN.—That was at Needles, California, across the Colorado river.

Mr. HOLGATE.—You might describe that briefly.

Mr. MILLIKEN.—That was erected in 1889-1890. I do not remember the length of the span.

Prof. GALBRAITH.—What river did it cross?

Mr. MILLIKEN.—Across the Colorado river at Needles, California.

Prof. GALBRAITH.—It would be quite a large span.

Mr. MILLIKEN.—Yes

Prof. GALBRAITH.—500 or 600 feet?

Mr. MILLIKEN.—More than that.

Prof. GALBRAITH.—Was it?

Mr. MILLIKEN.—It was about a 600 or 700 foot span, I should say, between the main piers.

Mr. HOLGATE.—A railway bridge?

Mr. MILLIKEN.—Yes.

Mr. HOLGATE.—Single or double track?

Mr. MILLIKEN.—Single track.

Mr. HOLGATE.—Mr. Deans just handed me a memorandum that the span you speak of is 660 feet. Would that be about what your recollection is?

Mr. MILLIKEN.—Yes, sir. I said 600 or 700 feet.

Mr. HOLGATE.—Well, Mr. Milliken, do you consider yourself essentially an erection man?

Mr. MILLIKEN.—Yes, sir.

Mr. HOLGATE.—Do you class yourself as an erection man or as an engineer?

Mr. MILLIKEN.—As an erection man.

Mr. HOLGATE.—In regard to your duties in connection with the Quebec bridge, we would like to know what personal attention you gave to the work.

Mr. MILLIKEN.—In the seasons of 1905 and 1906——

Mr. HOLGATE.—First of all, when was erection commenced?

Mr. MILLIKEN.—Actual erection?

Mr. HOLGATE.—Yes, sir.

Mr. MILLIKEN.—As I remember, June 23, 1905.

Mr. HOLGATE.—Now, then, go on.

Prof. GALBRAITH.—June, 1905?

Mr. MILLIKEN.—I am not sure about that.

Prof. GALBRAITH.—Roughly?

Mr. MILLIKEN.—July, 1905.

Prof. GALBRAITH.—That is the erection?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—The local preparation for erection commenced when?

Mr. MILLIKEN.—In the field?

Prof. KERRY.—Yes, at Quebec?

Mr. MILLIKEN.—It commenced in 1904 or the latter part of 1903.

Prof. GALBRAITH.—You mean the erection of false works?

Mr. MILLIKEN.—Yes, sir, getting in material and starting the erection of false work.

Prof. GALBRAITH.—1903?

Mr. MILLIKEN.—1904 is the first we started the erection of false work.

Prof. GALBRAITH.—1905 is when you started the bridge?

Mr. MILLIKEN.—Yes, sir, that is when we started the permanent structure.

Prof. GALBRAITH.—The false work in 1904, you say?

Mr. MILLIKEN.—Yes.

Mr. HOLGATE.—Now, that question of mine comes in: In regard to your duties in connection with the Quebec bridge, we would like to know what personal attention you gave to the work.

Mr. MILLIKEN.—In 1905 I was here most of the season after actual erection started and in 1906 I was here at least 80 per cent of the working season. In 1907 I was here about 50 per cent of the working season.

Mr. HOLGATE.—Do you keep a diary?

Mr. MILLIKEN.—No, sir.

Mr. HOLGATE.—When you were on the ground here did you assume any direct control of the work?

Mr. MILLIKEN.—Nothing except in a general way. When I was on the ground, if it was necessary to refer anything to me by our general foreman in charge, of course, he would do it.

Mr. HOLGATE.—Was your position then advisory only or was it executive?

Mr. MILLIKEN.—Unless something came up out of the general line of our erection, which, of course, had been laid out, the general run of the work. If anything unusual would arise he would probably refer it to me and confer with me.

Mr. HOLGATE.—And did confer?

Mr. MILLIKEN.—Yes, a number of times—not very often.

Mr. HOLGATE.—You refer now to matters in general, such as the inspection of the material that was to be erected and also to the method of its handling and placing in the bridge?

Mr. MILLIKEN.—Yes, sir; not to the inspection of the permanent material, but the inspection of our erection plant, travellers, &c. That was particularly looked after—constantly. But the material for the permanent structure we assumed to be all right when it arrived here for erection.

Prof. GALBRAITH.—To bring out Mr. Holgate's point more clearly, I think that his question refers more particularly to any orders or instructions in regard to the work that might be issued rather than to a conference which consisted simply in your being informed of the general state of the work at the time you arrived when you came from a distance, or an ordinary consultation. The particular point is, I think, this: Did you issue orders to Mr. Yenser, or did you, simply, every time there was any difference of opinion, come to an agreement with him? What was your process of working?

Mr. MILLIKEN.—Mr. Yenser would pursue the general course of the work whether I was absent or whether I was present. If there was anything that would arise during my presence here he would confer with me—anything out of the regular way.

Prof. KERRY.—In general you had created a local working organization which was responsible to you for the performance of its duties, but as long as everything was going smoothly you simply went on and let it work?

Mr. MILLIKEN.—Yes, sir; that is it; that is it exactly.

Mr. HOLGATE.—In deciding upon the method of the erection of this bridge, were you consulted by the head office?

Mr. MILLIKEN.—Yes.

Mr. HOLGATE.—You might just tell the process that was made use of in arriving at the determination of the method of the erection of the bridge.

Mr. MILLIKEN.—In my department there are a great many of the appliances. The plans were prepared in my department at Phœnixville and when they were fully prepared and what we consider ready for use they were referred to the computing department, which is directly under our designing engineer, Mr. Szlapka. When they had had a thorough check in my department and when the engineers thought it was all right, it was referred up there and rechecked, and if it was satisfactory it would go through. If not, any change that was recommended would have to be made.

Mr. HOLGATE.—Who finally had the approval of the erection methods?

Mr. MILLIKEN.—Mr. Szlapka—not the methods.

Mr. HOLGATE.—The methods I mean?

Mr. MILLIKEN.—The methods of the erection of the main structure was divided between Mr. Szlapka's department and my department; that is as to the actual workmanship and handling of the materials. We felt that was necessary on account of making detail drawings for the bridge. They often referred to my department and asked whether they could be handled all right in the field with safety. Then, that was discussed and determined. Of course, many details of that kind occurred during the preparation of the plans for the main structure.

Prof. GALBRAITH.—I think the questions are with reference simply to whether the arrangements that you made for erection were left altogether in your department or divided between you and Mr. Szlapka's department. I do not think that the question refers to a consultation between Mr. Szlapka's department having reference to the design of the parts of the structure and your department, or the consultations that they had with you as to whether they could be handled or not. I do not think that is what was meant; I think the question is, whether the work that we are now asking about was sometimes divided between you and Mr. Szlapka.

Mr. MILLIKEN.—No, that was in my department entirely.

Prof. GALBRAITH.—You said you had to send your designs for computation sometimes to Mr. Szlapka's department?

Mr. MILLIKEN.—Yes, as a matter of safety, particularly on this job, everything that was prepared, the appliances and everything of that kind in my department, were sent to Mr. Szlapka's department and checked.

Mr. HOLGATE.—Was that your ordinary procedure in cases of that kind?

Mr. MILLIKEN.—No, sir, only on this work.

Mr. HOLGATE.—Was it resorted to in connection with any other work?

Mr. MILLIKEN.—No, sir, it never has been, to my knowledge, except on the Quebec work?

Mr. HOLGATE.—For what reason?

Mr. MILLIKEN.—Well, on account of its great magnitude and the character of the work, which had never been done before, we were anxious to take every possible precaution and safety that were known to anybody.

Mr. HOLGATE.—What system of reports on this particular work had you, Mr. Milliken? I mean the reports that were sent to you, or the reports that you made to Mr. Deans?

Mr. MILLIKEN.—On account of my absence I never interfered with the regular course of reporting. Mr. Yenser made his reports daily, and we had some printed forms.

Mr. HOLGATE.—Where did Mr. Yenser's reports go?

Mr. MILLIKEN.—They went to Phœnixville, addressed to the Phœnix Bridge Company. We have some regular forms for reporting the number of rivets driven per day, and our car reports which were made up by the clerks in the office and simply signed by Mr. Yenser.

Mr. HOLGATE.—Could you give us a few samples of these reports that were made by Mr. Yenser?

Mr. MILLIKEN.—We have them at the bridge.

Mr. HOLGATE.—Are all the reports regarding the erection at the bridge now, or copies of them?

Mr. MILLIKEN.—Yes, sir. Mr. Cudworth, as resident engineer, made reports. Of course, he made these up himself on blue print diagrams which he had prepared in his certain way.

Prof. GALBRAITH.—This request has nothing to do with any particular incident on the bridge. At the present time we are only looking into the general system. A specimen of each report will do for the present.

Mr. MILLIKEN.—All right.

Mr. KERRY.—Mr. Milliken, will you tell us, as well as you can, the general system of handling the work that Mr. Yenser had with regard to reports, &c., that came in to him. We want to get an idea of the working organization he had under him, the character of the work, and with whom he would deal if he wanted any details of the work executed.

Mr. MILLIKEN.—Outside of the regular course?

Prof. KERRY.—It is the regular course we want to get more particularly, not anything out of the regular course, but the regular course itself.

Mr. MILLIKEN.—The regular course of the prosecution of the work would be for him to confer with or rather issue instructions to his assistant foreman, to Mr. Birks or Mr. Cudworth. The entire work was under his general direction.

Prof. KERRY.—He was constantly on the work?

Mr. MILLIKEN.—Constantly on the work, yes, sir.

Prof. KERRY.—And his reports from his assistant foremen would be written or verbal mostly?

Mr. MILLIKEN.—Verbal; he was among his men all the time; while I was present on the work he was right among them, constantly. It has occurred that he did not take time to come in and sign his letters, devoting his entire attention to the actual work of erection.

Prof. KERRY.—His general method would be simply to issue his instructions direct to his assistant foremen?

Mr. MILLIKEN.—Yes, sir, verbally.

Prof. KERRY.—And observe their carrying out?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Now, with regard to Mr. Birks, his detailed duties practically consist of what?

Mr. MILLIKEN.—Mr. Birks' duties consisted of keeping a close watch on erection to see that the members had been properly assembled and bolted up.

Prof. KERRY.—He would inspect the members before they were erected?

Mr. MILLIKEN.—He would inspect the attachments on the members. When a section of the main structure would come to the bridge for erection, we of course assumed that the member was all right, but the attachments for to put that member in place in the bridge, in its permanent position in the bridge, the attachments for that member was examined by Mr. Birks; that was one of his duties.

Prof. KERRY.—Then it was assumed that after a member left Phœnixville, unless some accident happened to it, it was perfect in every structural detail?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—As far as the member itself was concerned?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—That was accepted and Mr. Birks' duties consisted in seeing that it was properly erected, and all the attachments added to it were properly put on.

Mr. MILLIKEN.—Yes, sir, to see that the proper attachments according to our drawing was put on the member, and that it had its proper number of bolts on, and even after it got out on the bridge he would watch to see that the proper attachment for attaching our falls to it were all right. In other words, when they were ready to go ahead he would look it over and say: All right, go ahead.

Prof. KERRY.—His duties might be fairly described as an inspector of erection?

Mr. MILLIKEN.—Well, yes, sir, engineer and inspector of erection.

Prof. KERRY.—Did he have any specific duties with regard to the inspection of the structure as a whole? What I mean is, would his attention be more particularly directed all the time to the part that was being worked on, or had he any specific instructions to observe the entire structure, the parts already finished?

Mr. MILLIKEN.—He had no specific instructions to make any particular observations in that respect, at least not from my department.

Prof. GALBRAITH.—Whose duty was it to make the daily examination of lines and levels in the bridge as a whole or was there any such?

Mr. MILLIKEN.—Well, Mr. Cudworth was engineer in charge of the instrument work, and that was arranged for at different periods of the construction of the bridge, and at that particular period when that work was to be done, Mr. Cudworth was in charge of that part of the instrument work.

Prof. KERRY.—What system of record of progress existed, Mr. Milliken?

Mr. MILLIKEN.—Of erection?

Prof. KERRY.—What system of record of erection, how closely—for example a member is being put up or a joint is being completed, how closely was that progress recorded and what was the system?

Mr. MILLIKEN.—Sometimes we would have a general drawing laid before us and we would report to Phœnixville the particular members erected up to the time we made the report.

Prof. KERRY.—Each day?

Mr. MILLIKEN.—Each day.

Prof. KERRY.—Each day all the members put up in the last 24 hours were reported to Phœnixville?

Mr. MILLIKEN.—Yes, sir, and at Phœnixville they had their general drawings, the general plan of the bridge and they would mark on that plan with a lead pencil showing

just the progress we were making. They had it before them all the time on this general plan.

Prof. GALBRAITH.—Were these reports the reports referred to some time ago, as Mr. Yenser's reports?

Mr. MILLIKEN.—This marking up of our progress at Phœnixville would be taken from Mr. Yenser's report from day to day.

Prof. GALBRAITH.—Mr. Birks did not send an independent report or Mr. Cudworth?

Mr. MILLIKEN.—Mr. Birks made no independent reports; his report sometimes would be incorporated in Mr. Yenser's as the report of some particular matters, though that Mr. Birks had made reports. If there was any minor change that we thought better or suggested for the north side to simplify the erection why he would make that report.

Prof. KERRY.—Now, with regard to the connections there would be a large number of minor parts, fastenings, &c., which are not capable of direct identification, number or anything of that sort. What record is kept of their being put in place?

Mr. MILLIKEN.—Well, we had a detailed numbering of everything of all these attachments, every single one that was used in the bridge, and each attachment had its respective mark, and in failure to distinguish that mark Mr. Birks would always refer to his detailed plan, covering that particular attachment.

Prof. KERRY.—Perhaps I might illustrate there, Mr. Milliken. You have, for instance, one of the main pins. Then you have a little bolt running down the centre of the main pin, with what I might call covering plates at the end; for instance it might be reported that the pin itself would be in place but the little bolt inside might not be in place at the time of the report; would there be any system of report that would cover a detail like that?

Mr. MILLIKEN.—Whether he had that particular rod and those saucers or washers on the end——

Prof. KERRY.—In place, yes?

Mr. MILLIKEN.—Well, I cannot say that his report would cover that fully in detail, but to carry out the instructions, which we did, he would put that rod and those saucers in there just as soon as the pin had been driven through the bars.

Prof. GALBRAITH.—That is to say a piece of work like that would not be left to the next day?

Mr. MILLIKEN.—No, sir, that belonged to that connection and we had that right on the same car with that particular part.

Prof. GALBRAITH.—And the joint was completely finished, all the parts were assembled on it?

Mr. MILLIKEN.—Yes, sir; yes, sir; yes, sir.

Prof. GALBRAITH.—About the assembling of one of those tension joints, how long would the assembling and completion, the bolting up take?

Mr. MILLIKEN.—The driving of the pin in the permanent structure?

Prof. GALBRAITH.—Yes, the completion of that joint from beginning to end? How long a time for any particular joint after the pieces were laid, from the time of driving the bolt until the joint was completed?

Mr. MILLIKEN.—I think some of them would be made in 20 minutes.

Prof. GALBRAITH.—I just wanted to get an idea.

Mr. MILLIKEN.—The maximum time, as far as I know, is about an hour or an hour and a quarter.

Prof. KERRY.—How closely was the progress of riveting reported?

Mr. MILLIKEN.—Daily.

Prof. KERRY.—In what form?

Mr. MILLIKEN.—On a printed form which we have.

Prof. KERRY.—Showing exactly each rivet as driven?

Mr. MILLIKEN.—Showing the number of rivets driven, and our general book of

instructions designated what points we were to rivet, so that it was only necessary for us to report the daily number of rivets driven by the gangs.

Mr. HOLGATE.—The book of instructions? That is the first time we have heard that expression. You might just explain what that is.

Mr. MILLIKEN.—Well, it is a small book and pages were added to it, made up by Mr. Scheidal, the engineer in charge of the work, and this book comprised probably 50 or 60 pages, and was made up just as the work was completed in his office; he would follow with a page of instructions to us, and send it on to us and we would add it to this book.

Prof. KERRY.—Would there be any record that would show, is the system so close that if the office had been asked at a certain date what portions of the structure were riveted up, how closely could they have answered the question?

Mr. MILLIKEN.—Well, we could have answered it exactly, just what they had, the actual condition of the work.

Prof. KERRY.—That is to say the riveting gangs had absolute instructions as to the order in which rivets were to be put in?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—And those instructions are on record?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—And were followed?

Mr. MILLIKEN.—Yes, sir. Mr. Kinloch in a great many ways directed where the riveting should be done on account of the joint; they all had to be in perfect contact and that examination was made by Mr. Kinloch and that particular joint would not be driven until he said it was satisfactory.

Prof. GALBRAITH.—Would the reports include interim statements as to the condition of the riveted joints before the riveting took place, but after the pieces were partially bolted in position; would the reports state the condition of the bolting that preceded the riveting?

Mr. MILLIKEN.—The reports would indicate that, yes, sir, that the joints had been bolted up as instructed.

Prof. KERRY.—That would be Mr. Yenser's daily report?

Mr. MILLIKEN.—Yes, sir.

Prof. GALBRAITH.—Is there anything further along the line of general instructions, any further information that you could give us?

Mr. MILLIKEN.—Not at this time, I do not think of anything; no, sir.

Prof. GALBRAITH.—If you see clearly that we have omitted any important thing you ought to make the statement?

Mr. MILLIKEN.—Yes, sir, I will be glad to do that.

The commission took recess.

AFTERNOON SESSION—SECOND DAY.

The commission resumed at 2 o'clock.

Mr. HOLGATE.—Are there any matters, Mr. Milliken, that you would like to enlarge on or qualify?

Mr. MILLIKEN.—Well, in connection with my evidence this morning, I would like to add that at times when I was on the work I went out over the work, usually daily, sometimes once, but several times, and conferred with the different foremen, and would talk to them individually, as to their individual and general duties in connection with the work, and examined the work in a general way. Quite often I would meet them and walk back with them after the day's work was over, and caution and

urge upon them the necessity of being very careful, and I must say that in every case everyone understood the importance of being perfectly safe in handling all parts of the work, and on those visits I would take a general observation of the work and see that in a general way it looked all right to me. And I had been up there on Sundays when there was no work being done at all, and I looked over the work generally.

Mr. HOLGATE.—In looking over the work does that mean from track level, or would you make inspections through the various systems of chords and bracings?

Mr. MILLIKEN.—Only in a general way.

Mr. HOLGATE.—Would you say that that inspection was made from track level?

Mr. MILLIKEN.—From track level, yes, sir.

Prof. GALBRAITH.—The track had sufficiently large open spaces at the sides, say to look at the lower chords and the lower connections and everything of that kind as you went on?

Mr. MILLIKEN.—Oh, yes, I could see from the tracks.

Prof. GALBRAITH.—The track was not boarded over?

Mr. MILLIKEN.—No, sir, there was ties, and I walked on the outside and walked from the edge of a floor beam to one of the vertical posts and made general observations, not because my attention had been called to any particular part of the work, but simply as a matter of personal interest to look it over.

Prof. GALBRAITH.—I think Mr. Milliken was to show specimens of reports.

Mr. MILLIKEN.—I think they are on the way down now, I told them to bring them right to the court.

The witness retired.

FRANK E. CUDWORTH, recalled.

Mr. HOLGATE.—Will you state, Mr. Cudworth, just what your position is in connection with the Phœnix Bridge Company?

Mr. CUDWORTH.—I am resident engineer in charge of the instrument work.

Mr. HOLGATE.—How long have you been in that position?

Mr. CUDWORTH.—Three years.

Mr. HOLGATE.—Were you there at the inception of the instrumental work?

Mr. CUDWORTH.—No, sir, not the very first; as Mr. Milliken said, the work started in July and I came in September the same year.

Mr. HOLGATE.—But since September, 1904, you have been continuously employed by the Phœnix Bridge Company on the Quebec bridge?

Mr. CUDWORTH.—Not all the time at the Quebec bridge, not all the time in winter, but I have been here all the working season and two winters.

Mr. HOLGATE.—Whenever work has been going on on the Quebec bridge since September, 1904, you were there.

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—So that you then would have the continuous records of the instrumental work at that bridge?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—Who appointed you, Mr. Cudworth?

Mr. CUDWORTH.—I came here through Mr. Treadwell, who was consulted in regard to the foundations for the false work.

Mr. HOLGATE.—To whom were you responsible?

Mr. CUDWORTH.—When there was no foreman in charge of the work here in Quebec I was responsible to the head office in Phœnixville; when there was a foreman in charge of the work I was directly responsible to him and indirectly responsible to the Phœnixville office in special cases.

Mr. HOLGATE.—And in the case of your responsibility to the general foreman, who was he?

Mr. CUDWORTH.—There have been three general foremen here since I came.

Mr. HOLGATE.—The first was?

Mr. CUDWORTH.—The first was Mr. E. J. Wickizer, the second Mr. Shoemaker, and the third Mr. Yenser.

Mr. HOLGATE.—Were the instructions in regard to your work given you in writing or verbally?

Mr. CUDWORTH.—The instructions from the general foreman were given to me verbally, and I also received verbal instructions from both Mr. Deans and Mr. Milliken with reference to the work, and in some cases written instructions from Phœnixville.

Mr. HOLGATE.—Had you a system of reports?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—Daily reports?

Mr. CUDWORTH.—No, sir.

Mr. HOLGATE.—What were the periods at which they were made?

Mr. CUDWORTH.—The periods were at stated intervals, they were at times when the erection had progressed to a certain point.

Mr. HOLGATE.—They were not at regular intervals?

Mr. CUDWORTH.—No, sir.

Mr. HOLGATE.—To whom were those reports made?

Mr. CUDWORTH.—The reports were given to the foreman to go to Phœnixville. They went through the general foreman, through the office.

Mr. HOLGATE.—Have you copies of them, of these reports?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—You can let us have those?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—In connection with those reports had you any system of photography?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—Have you kept a consecutive series of photographs giving your work?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—Showing the progress?

Mr. CUDWORTH.—Showing the progress of the work.

Mr. HOLGATE.—If we could have those to look over too.

Mr. CUDWORTH.—Perhaps it would be better for you to consult either Mr. Deans or Mr. Milliken about this, as I have not all of them here.

Mr. DEANS.—We can furnish you a set of those views.

Mr. HOLGATE.—Whom did you consider your immediate superior, Mr. Cudworth, was it Mr. Yenser?

Mr. CUDWORTH.—Yes, sir; I received instructions from him in each case as to what work was needed immediately.

Mr. HOLGATE.—Could Mr. Yenser have dismissed you from the Phœnix Bridge Company's employ?

Mr. CUDWORTH.—I do not think he would have without consulting others; I could not say as to his authority to do that, but I do not think he would.

Mr. HOLGATE.—You did not think he could without reference to Phœnixville?

Mr. CUDWORTH.—No, sir.

Mr. HOLGATE.—Now you speak of the instrumental work; I wish you would just outline that work that comes under the head of instrumental work in connection with the making up of your periodical reports.

Mr. CUDWORTH.—In connection with the reports the instrumental work was such part of that work that you would use an instrument or rather engineers' appliances to get the information.

Mr. HOLGATE.—What information?

Mr. CUDWORTH.—The information as to lines and levels.

Mr. HOLGATE.—Lines of——

Mr. CUDWORTH.—Truss lines, or any lines or levels in connection with the work.

Mr. HOLGATE.—Lines of detailed parts of the structure?

Mr. CUDWORTH.—Yes, sir, and of the lines of the structure itself.

Prof. GALBRAITH.—Did you accept the lines and levels of the masonry work, or had they to be altered in any way for the purposes of the superstructure construction?

Mr. CUDWORTH.—The lines and levels used in building the bridge were given—the initial points were given by the Quebec Bridge and Railway Company's engineers, and they were checked in each case by myself.

Mr. HOLGATE.—And found correct?

Mr. CUDWORTH.—Yes, reasonably accurate.

Mr. HOLGATE.—In other words you did not start until you found these were correct?

Mr. CUDWORTH.—No, sir.

Mr. HOLGATE.—Now, was this instrumental work necessary continuously as erection progressed?

Mr. CUDWORTH.—Some of it was; yes, sir.

Mr. HOLGATE.—Just go over that, will you, with regard first of all to the erection of a panel of the bridge. Let us just understand your process with regard to the construction of the work. Take the cantilever arm, the panel in the cantilever arm?

Mr. CUDWORTH.—Well, in the cantilever arm the report of the elevation of the lower chord pins was taken immediately after the traveller was moved forward to erect a panel.

Prof. GALBRAITH.—That had been previously taken also?

Mr. CUDWORTH.—Yes, sir, it was taken every time the traveller was moved and at such other times as we considered necessary or convenient in erection; in fact the whole bridge was taken each time.

Mr. HOLGATE.—You worked back then, did you, from the land end and did you take those elevations continuously along all the points previously levelled over?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—And then out on the part being extended?

Mr. CUDWORTH.—Yes, sir, both on the anchor arm and the cantilever arm.

Mr. HOLGATE.—So that each time you did that you would have the information with regard to the levels and lines of the whole structure?

Mr. CUDWORTH.—It might not all be complete; as far as I remember they were complete in each case.

Mr. HOLGATE.—And these were recorded?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—And these were shown on your reports?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—And they will be in the reports that you will bring?

Mr. CUDWORTH.—Yes, sir.

Prof. GALBRAITH.—These levels to which you are now referring were the lines and levels of the lower chord pins only?

Mr. CUDWORTH.—Those were taken in each case and in some cases the othere as well.

Prof. GALBRAITH.—The other pins?

Mr. CUDWORTH.—Some of the pins or other points.

Prof. GALBRAITH.—Any of the main pins in the upper chord?

Mr. CUDWORTH.—They were taken in the case of alignment, not levels.

Prof. GALBRAITH.—In case of alignment, not of levels?

Mr. HOLGATE.—Did your duties, Mr. Cudworth, embrace everything in the way of the inspection of material or workmanship?

Mr. CUDWORTH.—No sir, not directly.

Mr. HOLGATE.—Did they at all?

Mr. CUDWORTH.—They did in this way, that if I should see anything that did not look right, I would report it.

Mr. HOLGATE.—What were your relations with Mr. Birks?

Mr. CUDWORTH.—In regard to what respect?

Mr. HOLGATE.—In respect to duties.

Mr. CUDWORTH.—As I stated before, mine was in connection with instrument work and his duties have been defined by the others.

Prof. KERRY.—You were officials of equal standing, but you had special duties to perform?

Mr. HOLGATE.—Were you under Mr. Birks' instructions in any way?

Mr. CUDWORTH.—No, sir, not directly.

Mr. HOLGATE.—Did he in any way check your work?

Mr. CUDWORTH.—Some of it we did together; yes, sir. Where he had work that required assistance, I assisted nim, and on the other hand, where I had work which required assistance, and there were no other people there, or for any other particular reason, I asked his assistance, he always gave it.

Mr. HOLGATE.—Now, did that occur in connection with the inspection of material?

Mr. CUDWORTH.—No, sir.

Mr. HOLGATE.—Not at all?

Mr. CUDWORTH.—I do not think of any instance.

Mr. HOLGATE.—Nor of workmanship.

Mr. CUDWORTH.—I do not recall any instance of that either.

Mr. HOLGATE.—What is your experience prior to coming on the Quebec bridge, Mr. Cudworth?

Mr. CUDWORTH.—Previous to working on the Quebec bridge I was in the Portsmouth navy yard, Department of Yards and Docks, a department of the navy of the United States government.

Mr. HOLGATE.—In what capacity were you there?

Mr. CUDWORTH.—I was there as draughtsman and inspector.

Mr. HOLGATE.—And for how long?

Mr. CUDWORTH.—About two years, as I remember; I do not know the exact date, I can furnish that if you wish. Before that I was in the Charlestown Navy Yard, as assistant to the engineer for the Philadelphia City Trust and Safe Deposit Company, who were finishing the contract for the Granite dry-dock in that yard.

Prof. GALBRAITH.—That is the yard at Boston?

Mr. CUDWORTH.—Yes, sir; and before that I worked for the City Engineer of Medford, Mass, before that on the erection of the Mount Washington Hotel at Burton Woods, New Hampshire.

Mr. HOLGATE.—Were any of these bridge structures?

Mr. CUDWORTH.—No, sir.

Mr. HOLGATE.—Then the first bridge structure that you had been connected with was the Quebec bridge?

Mr. CUDWORTH.—Yes, sir, the steel work at the hotel at Burton——

Mr. HOLGATE.—This other work, was it work calling for great accuracy?

Mr. CUDWORTH.—Yes, sir; there is that at the hotel and that at the Charlestown Navy Yard on the drydock was accurate work; they set the stones in that dock to one-eighth of an inch. If you wish those dates I can furnish them.

Mr. HOLGATE.—I do not think it is necessary. Besides those reports, is there any information that you think of in the way of diaries or other matter that you have that in your opinion would explain the matter any more clearly to us? If there is and we do not know of it, I wish you would collect it together and let us know about it, so that we can see if there is anything that would give us further information. Would those reports show anything out of alignment?

Mr. CUDWORTH.—Yes, sir, they give the alignment.

Mr. HOLGATE.—Do they give the alignment of the centre post?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—And any variations in alignment?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—Of the centre post?

Mr. CUDWORTH.—The alignment of the centre post has been taken continuously, I think, since the first section was placed each time the traveller was moved, and at any other times when it was in use in erection.

Mr. HOLGATE.—Would it also show the position in elevation of the anchor end post, and the main post?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—From time to time that would be shown?

Mr. CUDWORTH.—Yes.

Mr. HOLGATE.—Oh, by the way, you are a graduate and a civil engineer?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—What school?

Mr. CUDWORTH.—Thayer's school, in connection with Dartmouth College.

The witness retired.

NORMAN R. MCLURE, recalled:—

Mr. HOLGATE.—What is your position, Mr. McLure, in regard to the Quebec bridge?

Mr. MCCLURE.—I was inspecting engineer.

Mr. HOLGATE.—By whom were you appointed?

Mr. MCLURE.—By Mr. Theodore Cooper, with the approval of Mr. Hoare.

Mr. HOLGATE.—Is that appointment in writing?

Mr. MCLURE.—No, sir.

Mr. HOLGATE.—Was the approval in writing?

Mr. MCLURE.—I believe not, although I believe there was some correspondence.

Mr. HOLGATE.—Did any of that correspondence come to you?

Mr. MCLURE.—No, sir.

Mr. HOLGATE.—When were you appointed?

Mr. MCLURE.—I started my duties on April 10, 1905; I do not remember the exact date of appointment, it would be before that.

Mr. HOLGATE.—What were your duties?

Mr. MCLURE.—In the first place I was sent to the shops at Phœnixville, to assist the shop inspector until the erection started, and there, too, I familiarized myself with the details of the work. After that I had written instructions from Mr. Cooper as to my duties.

Mr. HOLGATE.—You have?

Mr. MCLURE.—Yes, sir.

Mr. HOLGATE.—Have you got them with you?

Mr. MCLURE.—Yes, sir.

(Document produced.)

Mr. HOLGATE.—Will you read that letter out, Mr. McLure, starting with the date? First of all, this is what, a letter of instructions from Mr. Cooper to yourself?

Mr. MCLURE.—Yes, sir.

(Reading):—

'August 26, 1905.

'You will proceed to Quebec and report to the chief engineer, Mr. E. A. Hoare.

'You will act in unison with the assistant engineer of the Phœnix Bridge Company in all matters of the erection.

'Make periodical inspection of the false work and plant.

'Watch the methods of handling and hoisting all the pieces to see that no risks of loss or injury to the members are taken during these operations.

'You will check with him all measurements and lines.

'You will see that the work as erected, is made secure before the next step is taken.

'See that the bed plates are exactly located and bedded according to the requirements.

'Report to me once a week the progress and condition of the work. If any unforeseen difficulties occur in the operations describe the same clearly so that I can keep in touch with the work.

'You will watch during the various conditions of the erection the changing cambers and opening and closing of the joints. While these changing joints are to be made secure, temporarily you will not permit them to be riveted until in proper condition.

'You will carry out such other instructions as may be given you by the chief engineer.

'You will keep an office diary of the work done each day, and note therein any points of special interest.

THEODORE COOPER.'

Mr. HOLGATE.—These reports, were they duly made?

Mr. MCLURE.—Yes.

Mr. HOLGATE.—On a proper form?

Mr. MCLURE.—The weekly reports?

Mr. HOLGATE.—Yes?

Mr. MCLURE.—No, just by letter.

Mr. HOLGATE.—Have you copies of these?

Mr. MCLURE.—Yes.

Mr. HOLGATE.—Just make a note to get these reports together.

Mr. MCLURE.—They are all in one letter book.

Mr. HOLGATE.—Make a note of the letter book, then. It will appear from that letter of Mr. Cooper's that you might, from time to time, receive instructions from Mr. Hoare?

Mr. MCLURE.—Yes, sir.

Mr. HOLGATE.—Did you?

Mr. MCLURE.—Not in writing.

Mr. HOLGATE.—No instructions in writing?

Mr. MCLURE.—No, sir, all verbal.

Mr. HOLGATE.—When instructions of a verbal nature would be given by Mr. Hoare, would these be noted in your diary?

Mr. MCLURE.—I do not think so.

Mr. HOLGATE.—What would your diary consist of?

Mr. MCLURE.—Just the material erected each day and any unusual point that might turn up.

Mr. HOLGATE.—Would it indicate Mr. Hoare's presence on the work?

Mr. MCLURE.—No, sir; it might in a few instances, but not every time.

Mr. HOLGATE.—To whom did you consider yourself directly responsible on the work?

Mr. MCLURE.—To Mr. Cooper and Mr. Hoare jointly.

Mr. HOLGATE.—Was there any precedence? Did Mr. Cooper dominate any more than Mr. Hoare, or vice versa?

Mr. MCLURE.—I never had any occasion to bring that question up.

Mr. HOLGATE.—In case of difficulties arising, whose opinion or judgment did you rely upon?

Mr. MCLURE.—I would have relied upon Mr. Cooper, as he was a specialist.

Mr. HOLGATE.—Did you ever have occasion to consult Mr. Cooper on matters that you did not consult Mr. Hoare upon?

Mr. MCLURE.—Never on matters that I did not notify Mr. Hoare about at the same time.

Mr. HOLGATE.—When Mr. Hoare was notified of these matters did he deal with them himself or did he submit them to Mr. Cooper.

Mr. MCLURE.—Not if I told him that I had referred them to Mr. Cooper also. He relied upon Mr. Cooper's decision.

Mr. HOLGATE.—What matters did Mr. Hoare deal with?

Mr. MCLURE.—As far as I was concerned principally with the monthly estimates of the material erected.

Mr. HOLGATE.—Did you make these returns to Mr. Cooper?

Mr. MCLURE.—Estimates of material erected?

Mr. HOLGATE.—Yes?

Mr. MCLURE.—No, sir; I made them direct to Mr. Hoare.

Mr. HOLGATE.—Mr. McLure, you might give us an idea of the routine of your monthly work, embracing your various duties. Trace out, for instance, the arrival of material and its progress.

Mr. MCLURE.—Our months were so different and irregular that it is pretty hard to compare one with another.

Mr. HOLGATE.—Take it consecutively from, say, the arrival of material on cars at the site forward to its destination at the bridge.

Mr. MCLURE.—On its arrival at the bridge I always made it a point to look every piece over thoroughly before being erected, to see if I could find anything wrong with it.

Mr. HOLGATE.—In what way did you check that?

Mr. MCLURE.—By eye.

Mr. HOLGATE.—Yes?

Mr. MCLURE.—And in the case of pins, by measurement and spacing of eye bars by measurement. I watched the attachment of the erection appliances and the handling of all the pieces while being erected to see that no injury was by any chance done to them. I watched the driving of all pins and the making of every connection.

Prof. GALBRAITH.—You saw that the men followed the blue printed instructions?

Mr. MCLURE.—Yes, sir, I made myself satisfied that they did.

Prof. KERRY.—You had copies of all these instructions?

Mr. MCLURE.—Of practically all.

Prof. KERRY.—Which were given you by———?

Mr. MCLURE.—Which were furnished me by the Phœnix Bridge Company.

Prof. KERRY.—Through Mr. Yenser?

Mr. MCLURE.—Sometimes and sometimes direct.

Mr. KERRY.—From the office?

Mr. MCLURE.—From Phœnixville.

Mr. HOLGATE.—In your inspection of material had you the right to reject it?

Mr. MCLURE.—In the event of damage?

Mr. HOLGATE.—In the event of anything being incorrect or not suitable for the work.

Mr. MCLURE.—Not before reporting it to Mr. Hoare.

Mr. HOLGATE.—Your process then would be, if you found anything of that nature, to report it to Mr. Hoare?

Mr. MCLURE.—Yes.

Mr. HOLGATE.—Would he decide?

Mr. MCLURE.—I do not know. That is for him to say.

Mr. KERRY.—Were there specific cases in which it did happen?

Mr. MCLURE.—No, sir, we never had occasion to reject anything on the erection.

Prof. KERRY.—All the material that came down was satisfactory and was erected?

Mr. McLURE.—Yes, sir.

Prof. KERRY.—You never had occasion to send a piece back from the bridge?

Mr. McLURE.—Never.

Mr. HOLGATE.—Were these inspections here made at the bridge when the Phœnix Bridge Company brought the material up for erection, or were they made in the yard?

Mr. McLURE.—At the bridge—on the cars on the bridge.

Mr. HOLGATE.—On the erection cars?

Mr. McLURE.—Yes, sir.

Mr. HOLGATE.—There was no inspection previously on your part?

Mr. McLURE.—Occasionally there was in the storage yard.

Prof. KERRY.—Under what circumstances?

Mr. McLURE.—I made frequent visits to the storage yard just to look the metal over—not for any specific purpose.

Mr. HOLGATE.—Your duties then did not extend to the material in the storage yard?

Mr. McLURE.—No, sir.

Mr. HOLGATE.—Who, representing the Quebec Bridge Company, would have duties extending there?

Mr. McLURE.—Mr. Kinloch, I should think.

Mr. HOLGATE.—Who is Mr. Kinloch?

Mr. McLURE.—Inspector.

Mr. HOLGATE.—Whose inspector?

Mr. McLURE.—Mr. Hoare's.

Mr. HOLGATE.—Whose directions did he come under?

Mr. McLURE.—Mr. Hoare's.

Mr. HOLGATE.—Is he under you in any way?

Mr. McLURE.—Not in any way.

Mr. HOLGATE.—You kept a diary, Mr. McLure?

Mr. McLURE.—Yes, sir.

Mr. HOLGATE.—And you made these periodical reports?

Mr. McLURE.—Yes, sir.

Mr. HOLGATE.—You have all these?

Mr. McLURE.—Yes.

Mr. HOLGATE.—Have you any further details of the progress of the work on record? For instance, take the case—I only mention it as an instance showing what I mean—of the assembling of joints, the riveting of joints and their condition?

Mr. McLURE.—You mean in the erection?

Mr. HOLGATE.—Yes, their condition from time to time and up to August 29.

Mr. McLURE.—I have some records in field notebooks, outside of the diary.

Mr. HOLGATE.—You might look these up, Mr. McLure. We will want these later.

Mr. McLURE.—Do you want the diary, too?

Mr. HOLGATE.—Yes. And if you have any photographs of various points that would explain anything in the reports or the diary I wish you would look them up, too, and let us have them altogether?

Mr. McLURE.—All right.

Prof. KERRY.—Had you any regular method of recording progress, Mr. McLure, in the sense of recording when each member was placed and when each connection was complete?

Mr. McLURE.—I have diagrams showing the date when each main member was erected, and I incorporated in my weekly reports to Mr. Cooper a diagram showing the condition of the erection. That will be with my reports.

Prof. KERRY.—But in regard to the details as to the connection?

Mr. McLURE.—As to the bolting?

Prof. KERRY.—Yes, the bolting and riveting.

Mr. McLURE.—No, I have not any detailed reports on that.

Prof. KERRY.—You have no record of progress?

Mr. MCLURE.—No, sir.

Prof. KERRY.—You stayed here all through the year, Mr. McLure?

Mr. MCLURE.—Only during the erection.

Prof. KERRY.—What would you be doing in the balance of the year?

Mr. MCLURE.—I would be in Phœnixville helping the shop inspectors.

Prof. KERRY.—Inspecting the material in its preparation?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Have you any other records of any kind that we have not heard of, Mr. McLure, in the way of technical records bearing on the work, such, for example as wind and deflection records or anything of that kind?

Mr. MCLURE.—They will all be incorporated either in my diary or in my field notes, both of which I have noted here.

Prof. KERRY.—They are not kept as a separate record?

Mr. MCLURE.—No, sir.

Prof. GALBRAITH.—Have you a record of all the movements made by the bridge after the erection of each part or, say, at stated intervals, the general movements that are made in the construction of the bridge?

Mr. MCLURE.—Yes, sir.

Prof. GALBRAITH.—You have that complete?

Mr. MCLURE.—Yes.

Prof. GALBRAITH.—The time, temperature, wind stress, condition of the joints and everything else?

Mr. MCLURE.—Yes. I have it complete, but it is in my notes.

Prof. GALBRAITH.—It can be worked out from your notes?

Mr. MCLURE.—Yes, sir.

Prof. GALBRAITH.—You can answer questions on any of these points?

Mr. MCLURE.—Yes.

Prof. KERRY.—Is that information that Prof. Galbraith has spoken of condensed to any extent in your reports?

Mr. MCLURE.—Yes.

Mr. HOLGATE.—To what extent, if at all, did you check up the work of Mr. Cudworth and Mr. Birks?

Mr. MCLURE.—Mr. Cudworth and I usually worked together. We helped each other. We get the same information at the same time.

Prof. KERRY.—In the question of levels, for example, just as an instance, would they be taken once or taken twice?

Mr. MCLURE.—Taken once.

Prof. KERRY.—One man observing it?

Mr. MCLURE.—One man observing it.

Prof. GALBRAITH.—It would be taken by the two of you?

Mr. MCLURE.—Yes, we worked together.

Prof. KERRY.—It really would not be a check?

Mr. MCLURE.—No.

Prof. KERRY.—Two men worked together?

Mr. MCLURE.—Yes.

Prof. KERRY.—One man with the rod and the other with the level?

Mr. MCLURE.—Yes.

Mr. HOLGATE.—Was there any checking on your part?

Mr. MCLURE.—Of the levels?

Mr. HOLGATE.—Yes.

Prof. KERRY.—Independently of the work of Mr. Cudworth?

Mr. MCLURE.—In a few instances.

Mr. HOLGATE.—How did you find that checking? Do you recollect an instance?

Mr. MCLURE.—I do not just remember now.

Prof. GALBRAITH.—Did you make these checks together or did you do it yourself? Was Mr. Cudworth with you repeating the work of checking?

Mr. MCLURE.—No, not at any time that I would consider it a check.

Prof. KERRY.—Will you run over briefly, your general experience, Mr. McLure, please, and where you graduated?

Mr. MCLURE.—I graduated at Princeton University. I executed dock work for the Pennsylvania railroad, ran profile for the Pennsylvania railroad as chainman and rodman, instrument man on the Baltimore & Ohio railroad and in the divisional engineer's office with the Erie railroad, and inspector of bridges for the New York, Ontario & Western railway.

Prof. KERRY.—That is part of the maintenance of way of the railway?

Mr. MCLURE.—Yes, sir; maintenance of way and construction, both in the same department.

Prof. KERRY.—Any structures of importance?

Mr. MCLURE.—The principal structures were long viaducts.

Prof. KERRY.—You might give the stenographer the dates of your whole connection—the dates of your graduation and so on.

Mr. MCLURE.—Graduated 1904; Pennsylvania railroad 1901; Baltimore & Ohio 1902; Erie 1903; Ontario & Western 1904-5.

Mr. HOLGATE.—You said you graduated when?

Mr. MCLURE.—1904. This is summer work.

Mr. HOLGATE.—In what capacities were you on these works, Mr. McLure?

Mr. MCLURE.—I started in as chainman on the Pennsylvania railroad and got to be inspector. At the end of my work I was inspecting construction. On the Baltimore & Ohio I was instrument man, on the Erie in the same capacity, and on the Ontario & Western, inspector of bridges.

Mr. HOLGATE.—In responsible charge of these bridges?

Mr. MCLURE.—Yes, sir; both old structures and new structures.

Mr. HOLGATE.—How do you mean about that responsible charge, Mr. McLure?

Mr. MCLURE.—I was responsible to the engineer of maintenance of way.

Mr. HOLGATE.—Were you in responsible charge of the Quebec bridge?

Mr. MCLURE.—What do you mean by responsible charge?

Mr. HOLGATE.—What is your official designation?

Mr. MCLURE.—As I understand it, it was inspecting engineer; that is what I was on the roll as.

Mr. HOLGATE.—In the event of necessity arising, which it did not, who could dismiss you?

Mr. MCLURE.—Either Mr. Hoare or Mr. Cooper, I should think.

Mr. HOLGATE.—Either one or the other?

Mr. MCLURE.—I should think so. I do not like to state personally. I know Mr. Cooper could.

Mr. HOLGATE.—You know that Mr. Cooper could?

Mr. MCLURE.—Yes, sir.

Mr. HOLGATE.—Are you sure that Mr. Hoare could not?

Mr. MCLURE.—No, sir.

Mr. HOLGATE.—Were you doubtful?

Mr. MCLURE.—That is rather an embarrassing question.

Prof. KERRY.—You were paid by the Quebec Bridge Company?

Mr. MCLURE.—By the Quebec Bridge Company?

Prof. KERRY.—Not by Mr. Cooper.

Mr. MCLURE.—No, sir.

Prof. GALBRAITH.—You were paid by the Quebec Bridge Company?

Mr. MCLURE.—Yes, sir; so was Mr. Cooper.

Mr. HOLGATE.—Do you feel that you would like to explain anything in regard to what you have said, Mr. McLure, that would make it clearer?

Mr. McLURE.—I do not think of anything just now unless there are some points you would like to have explained.

Mr. HOLGATE.—I do not think so. I thought that perhaps from your own point of view you might like to say something. If you would be good enough to get together those things——

Mr. McLURE.—Yes, I have a memorandum down here. I will bring everything together.

Witness retired.

EPHRAIM ROBERT KINLOCH, sworn.

Mr. HOLGATE.—What is your position, Mr. Kinloch?

Mr. KINLOCH.—Inspector.

Mr. HOLGATE.—Inspector of what?

Mr. KINLOCH.—According to my instructions from Mr. Hoare, workmanship and general erection inspector.

Mr. HOLGATE.—By whom were you employed?

Mr. KINLOCH.—Mr. Hoare.

Mr. HOLGATE.—And to whom do you report?

Mr. KINLOCH.—I make no written reports. I report verbally to Mr. Hoare.

Mr. HOLGATE.—Was there any one on the work that you took instructions from?

Mr. KINLOCH.—No, sir. I say that advisedly. If anything turned up in the engineering line I had orders to consult with Mr. McLure in regard to what to do with it. That is outside of workmanship. If I would find anything that did not suit me in the line of the work, I took it up with Mr. McLure.

Mr. HOLGATE.—When were you appointed?

Mr. KINLOCH.—I have been twice on the one job. I was on the approach spans and then I was off and on again. I first came here for the Pittsburg Testing and Laboratory Company from Chicago, on the approach spans on the south shore, and when I left, Mr. Hoare asked me if I would come back for the big spans. We had some conversation on it and I told him that I would be glad to come back if I was not tied up some place else. That was in 1903.

Prof. GALBRAITH.—That was the last time, was it?

Mr. KINLOCH.—No, the first. We had some correspondence. I wrote to him; from 1904 to 1905 I was in Omaha, Nebraska—and he said that he would hold a position open for me. When I finished in Omaha I wrote to him again and he sent for me to come on. I think that was in June. I arrived here Dominion Day, I think—I have a diary of it—but it was either Dominion Day, or a matter of a day or two—I haven't it in mind—in 1905.

Mr. HOLGATE.—What was the condition of the work then?

Mr. KINLOCH.—They were just tipping out the jib on the traveller and there was a lot of wooden false work. They had not started to raise any iron or steel.

Mr. HOLGATE.—You were there practically during the erection of the anchor span?

Mr. KINLOCH.—Yes, sir, entirely.

Prof. KERRY.—And you were previously there as inspector representing the Inspection Company on the erection of the fixed span?

Mr. KINLOCH.—The approach span.

Prof. GALBRAITH.—Were you employed by the inspection company or Mr. Hoare?

Mr. KINLOCH.—At that time I was.

Prof. GALBRAITH.—What did you call that company,

Mr. KINLOCH.—The Pittsburg Testing and Laboratory Company; it has another name in this country, I guess.

Prof. GALBRAITH.—From Chicago?

Mr. KINLOCH.—Pittsburg.

Prof. GALBRAITH.—I thought you said Chicago?

Mr. KINLOCH.—They have offices all over. I was working out of the Chicago office when I was ordered here.

Mr. HOLGATE.—Let us understand clearly, Mr. Kinloch, what you understood your duties to be and as you carried them out. Begin with the arrival of the construction material and go right on.

Mr. KINLOCH.—Well, I was supposed to see that the iron was in good shape before it went into the bridge.

Mr. HOLGATE.—Where?

Mr. KINLOCH.—Whenever I got a chance to inspect it. As a general thing I got it on the bridge.

Mr. HOLGATE.—What was your system?

Mr. KINLOCH.—My system was when a car came in there to get on the car.

Mr. HOLGATE.—That is a car from the railway delivering the material?

Mr. KINLOCH.—No, the car from the storage yard. That is most of it; some of it we got over in the storage yard and before it was off the car, and some we got in a pile in the storage yard. There was no general inspection over there, but in case we discovered some little thing working one way we went over to the storage yard to see if there was anything more of the same kind, regarding the painting and one thing and another in that way.

Mr. HOLGATE.—You never went over to the storage yard except under those conditions?

Mr. KINLOCH.—No. At first when I did not have anything to do I put in pretty nearly all the time over in the yard familiarizing myself with the different pieces.

Mr. HOLGATE.—It was not part of your duty to make any inspection in the storage yard,

Mr. KINLOCH.—No, sir, I did not consider it as such.

Mr. HOLGATE.—And you did not do it?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Then where did your inspection begin?

Mr. KINLOCH.—It began before the iron got into the bridge.

Mr. HOLGATE.—On delivery cars from the storage yard?

Mr. KINLOCH.—Mostly; yes, sir.

Mr. HOLGATE.—And how was that inspection made?

Mr. KINLOCH.—When a piece came in I got up and looked at it to see if it was straight and no bent members in it. I did not check it up by measurement to see if it complied with the plans but I gave it a general inspection for workmanship and to see that it had not been damaged any since it left the other inspector.

Mr. HOLGATE.—Where was he?

Mr. KINLOCH.—At Phœnixville, I suppose.

Mr. HOLGATE.—What marks would you recognize to show you that it had gone through that inspector's hands?

Mr. KINLOCH.—A big letter 'Q' with a stamp in the centre of it—'Q B.'

Mr. HOLGATE.—And if you did not see that you would not pass the piece?

Mr. KINLOCH.—If I did not see that I would just simply look at it and see that it was all right.

Mr. HOLGATE.—Were these marks on every piece?

Mr. KINLOCH.—I could not swear they were.

Prof. GALBRAITH.—Then a piece might have been passed without that mark on, as far as you know?

Mr. KINLOCH.—It might have passed him without that mark on, yes. I never looked for the mark on every piece.

Mr. HOLGATE.—Did you mark them yourself?

Mr. KINLOCH.—Not unless there was something wrong with them.

Mr. HOLGATE.—Was there any report sent up from the inspector's saying that this piece had been inspected?

Mr. KINLOCH.—To me?

Mr. HOLGATE.—Had any report reached you through any channel at all saying that the various parts had been inspected and passed by the inspectors at Phœnixville?

Mr. KINLOCH.—No.

Prof. KERRY.—In case a member had something wrong with it, what was your procedure?

Mr. KINLOCH.—It depends on what it was. A bent angle, or something like that; I simply marked it to be straightened or cut off. I never found anything but simply some trifling thing like that.

Prof. GALBRAITH.—You wrote your direction on the piece, did you?

Mr. KINLOCH.—Yes. I examined the joints to see that they were clear of rust and stuff like that or anything that was liable to be in them so that when they went to make them they could not pull them in. In the case of bars I measured the bars to see that they were the right bars and that they were painted before assembling. I also examined any piece that went in an inaccessible place to see that it was painted because it could not be painted after it was up. I made a general all round inspection to see that every thing was in good workmanlike shape.

Mr. HOLGATE.—In detail, now, on the inspection, what about the inspection and the placing of members and their connections, riveting and bolting and things of that nature? Just give us clearly how you proceeded with the work and what was your system of inspection.

Mr. KINLOCH.—I do not just get your meaning, Mr. Holgate.

Mr. HOLGATE.—Did you have a specification or definite instructions to guide you in your inspection, and did you carry out your inspection up to these instructions?

Mr. KINLOCH.—I have a copy of a little pamphlet from the Phœnix Company giving the method of erection.

Mr. HOLGATE.—Have you that now?

Mr. KINLOCH.—No, I haven't it here.

Mr. HOLGATE.—Would you recognize it if you saw it?

Mr. KINLOCH.—Yes, sir.

(Mr. Deans handed to the chairman a number of small blue prints fastened together.)

Mr. HOLGATE.—Have you your own copy, Mr. Kinloch?

Mr. KINLOCH.—Yes, sir. I have not this in full. It is one similar to it.

Mr. HOLGATE.—But you have your own copy and can produce it?

Mr. KINLOCH.—Yes.

Mr. HOLGATE.—It is generally in this form, but you do not know that it is the same?

Mr. KINLOCH.—I am just shy some pages; that is all.

Mr. HOLGATE.—You can produce your own copy?

Mr. KINLOCH.—Yes.

Mr. KERRY.—You inspected the workmanship on the joints, as it were, put in on the bridge in detail, Mr. Kinloch?

Mr. KINLOCH.—You mean when they were riveted?

Prof. KERRY.—Yes?

Mr. KINLOCH.—There was no riveting done on the joints until a long time after they were put in?

Prof. KERRY.—The joints were just bolted and let stay?

Mr. KINLOCH.—Yes, sir. With the peculiar method of erection they had here they could not do it otherwise. The holes did not come good.

Prof. KERRY.—You checked up the temporary fastenings which could not be riveted?

Mr. KINLOCH.—Yes.

Prof. KERRY.—To see——?

Mr. KINLOCH.—To see that they were safe.

Prof. KERRY.—Sufficiently bolted?

Mr. KINLOCH.—Yes.

Prof. KERRY.—You were guided in that by the instructions of the Phœnix Bridge Company?

Mr. KINLOCH.—I——

Prof. KERRY.—How did you determine whether a joint was sufficiently bolted?

Mr. KINLOCH.—By the instructions of the Phœnix Bridge Company and by my own experience.

Prof. GALBRAITH.—Would you fill all the holes with your bolts that could be filled at the time?

Mr. KINLOCH.—We filled them all before we got the maximum weight they were to get.

Prof. GALBRAITH.—In any particular state were all the holes that possibly could be filled with the bolts you had, filled? Of course, that is a matter that I had better perhaps avoid at present.

Mr. KINLOCH.—The chord joints were filled with what sizes of bolts they could get in.

Prof. GALBRAITH.—All the chord joints were filled?

Mr. KINLOCH.—Yes, practically.

Prof. GALBRAITH.—Where they overlapped, assuming that you had no bolts small enough, these were necessarily left out?

Mr. KINLOCH.—I do not think that there were any left out. They had bolts down as small as five-eighths.

Prof. KERRY.—The joints were completely bolted?

Mr. KINLOCH.—Practically so. There might be 20 or 30 bolts out of a joint where there were 400.

Mr. HOLGATE.—What jurisdiction had you over the men who were actually doing the work?

Mr. KINLOCH.—Mr. Holgate, I do not know as I had any, but if I found a man doing anything wrong I stopped him. I do not know where I got that authority to do that any more than any inspector would have. No one told me I could, but I simply did it, and if he would not stop I took it to the foreman, and I never had to do any more than that.

Mr. HOLGATE.—But you had not definite instructions to guide you in a case of that kind?

Mr. KINLOCH.—No, I did not think any were necessary.

Mr. HOLGATE.—You did not find it necessary in the progress of the work to get written instructions?

Mr. KINLOCH.———

Prof. KERRY.—During the work everything that you considered necessary as to the quality of the workmen or of the workmanship was done on your request?

Mr. KINLOCH.—There is a line to draw. There were some things I wanted done that I did not get done, but they were taken up and they never have been settled yet. It was out of the line of workmanship, though.

Prof. KERRY.—As far as the line of workmanship is concerned?

Mr. KINLOCH.—I never had any trouble.

Prof. KERRY.—Everything you wanted was done?

Mr. KINLOCH.—Yes.

Mr. HOLGATE.—In regard to the other matters that you have just referred to, do they concern the matter?

Mr. KINLOCH.—Concern the——?

Mr. HOLGATE.—This question?

Mr. KINLOCH.—You mean the collapse?

Mr. HOLGATE.—No, but the explanation of your duties.

Mr. KINLOCH.—I do not just understand you.

Mr. HOLGATE.—Perhaps we will bring that up again and we will give you a full

chance to explain what you mean. What has your previous experience been in bridge erection?

Mr. KINLOCH.—I have been at it ever since I have been a boy—since I was 16 years old.

Mr. HOLGATE.—What large or important structures have you had to do with?

Mr. KINLOCH.—The Chillicothe bridge across the Illinois, the Fort Madison across the Mississippi river, the Cairo bridge across the Ohio, Merchant's bridge at St. Louis across the Mississippi, a lot of small spans, over 150 feet of one kind and another, the Boone viaduct, Iowa, St. Joe bridge across the Missouri river, the Omaha draw, and numerous bascule bridges in Chicago.

Mr. HOLGATE.—In connection with these works were you the foreman or superintendent in charge of the erection?

Mr. KINLOCH.—No, sir; on some of them I just worked, on some of them I was inspector, on some of them I was in charge, and on some of them I was the assistant.

Mr. HOLGATE.—On which of these were you in chief charge?

Mr. KINLOCH.—On the bascules in Chicago I had charge of putting in all the machinery, operating them, turning them over to the drainage and instructing the drainage how to run them.

Prof. GALBRAITH.—That is for the drainage canal?

Mr. KINLOCH.—For the drainage canal.

Prof. HOLGATE.—Is that the only one?

Mr. KINLOCH.—There were Main street, State street, Randolph street and Canal street—four of them. I was there for three or four years.

Prof. KERRY.—It might be well to trace back these structures that you mention and say what your connection was with each one of the more important of them?

Mr. KINLOCH.—The Chillicothe bridge, the first one I worked on, I worked on the preliminary survey, and all the way from pile driver to inspector of masonry. Then, I was on the Sante Fé. That was on the construction of the Sante Fé. I was in the engineering department. The rest of the gang got laid off. We gradually extended our division until we took in all those bridges and I had to do with this in the capacity of inspector under Mr. Richardson. From there I went to Cairo where I worked as a common labourer and afterwards as bridge man. I worked in the gang hustling iron and then I worked as an erector. After that I just had different jobs around. I worked just as an erector until 1896 or 1897, I think. I was assistant foreman on the Chicago & Northwestern Elevated Railway. That was about the time the American Bridge Company organized, and I was assistant foreman for them on all the work while I was with them—Boone, St. Jo, and the bascules—I had charge of the machinery.

Prof. KERRY.—After you left the American Bridge Company?

Mr. KINLOCH.—In the erection of the large Glasgow bridge across the Missouri, I was inspector for Mr. Zeising. I was also inspector of the Chicago and Northwestern railway on small jobs. I was with them for about six or seven months. Practically the whole of the time since 1887 I have been working on large bridges, with the exception of four years, when I was home.

Prof. KERRY.—You have had practically ten years' experience as assistant foreman?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And about how many years' experience as inspector previous to 1905?

Mr. KINLOCH.—I was a year on that Glasgow job, I guess—almost a year; about eight or nine months with the Chicago and Northwestern, and, of course, I was with the Sante Fe for a couple of years when I was inspecting, but I did not know very much about it. I also put up a 200-foot span when I was home in the city. I was clerk at the time and I had charge of that, we took it away from the contractor, the company kind of fell down on it, and could not put it up after they got it.

Mr. HOLGATE.—Had you authority, Mr. Kinloch, to stop work on the part of the men engaged in doing it? Could you stop the work of a gang of men on the bridge?

Mr. KINLOCH.—No, sir; I had no authority to do that, not without taking it up with Mr. Hoare.

Mr. HOLGATE.—Who had?

Mr. KINLOCH.—I do not know.

Mr. HOLGATE.—In the event of your finding something that you thought it necessary to stop work in a certain place—I mean who had the authority to stop that work?

Mr. KINLOCH.—Mr. Yenser, I guess.

Mr. HOLGATE.—Mr. Yenser, you think had authority. Could you have stopped it?

Mr. KINLOCH.—Through Mr. Yenser I could, or by taking it up with Mr. Hoare I could stop it. Individually I could not go down and tell those men to stop, no.

Mr. HOLGATE.—You could not order them to stop?

Mr. KINLOCH.—No, sir.

Prof. GALBRAITH.—Did you consider it to be your duty in case you saw anything going wrong to talk with the foreman engaged in the work, and first to see if you could not get it made right, and if you should fail in having your suggestions adopted did you ever go to Mr. Yenser or Mr. Hoare or did you feel that it was your duty to go to Mr. Yenser or Mr. Hoare, or both?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—You felt that lay within your duties?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Do you feel that your presence there as inspector produced any better work than if you had not been there?

Mr. KINLOCH.—You mean if there had been no inspector there, or just me?

Mr. HOLGATE.—If there had been no inspector?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—You think so?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—You think that by keeping active and about the work it was an advantage to the work?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—That there were matters that you detected that upon speaking about them they were rectified?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Did that apply to all matters that you brought up? I do not want you to specify any matters?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Did it or did it not?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Those are matters that you referred to a little while ago, then?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—What general inspection did you give the structure in addition to seeing that the members were in good condition, seeing that the riveting was properly done? Did you give attention to the structure as a whole? Did you watch how it was working as it was extended out?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—That was among your duties, you considered that it was, at least?

Mr. KINLOCH.—I considered it myself amongst my duties to take a general watch and see how everything was working.

Prof. KERRY.—You have no specific instructions?

Mr. KINLOCH.—I had no specific instructions to go over it at stated intervals, over the work. My instructions were to see that everything was safe.

Prof. KERRY.—How often would you go over the structure? These instructions to see that everything was safe came from Mr. Hoare?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And how often would you go over the structure for that purpose?

Mr. KINLOCH.—Well, it depended a good deal on the movements of the traveller and the different stages of erection.

Prof. KERRY.—Just whenever you thought it necessary.

Mr. KINLOCH.—Yes, sir, I had no stated intervals, sometimes it might be——

Prof. KERRY.—At that time would you go completely over the main members, for instance?—Would you pass along the top chord and see that everything was in order?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And pass along the top chord before saying that everything was in order?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—It would not be a distant inspection, but a quite close detailed examination ?

Mr. KINLOCH.—Yes, sir.

The witness retired.

NORMAN R. McLURE, recalled.

Mr. HOLGATE.—With regard to your authority in case of emergency conditions arising, how far did it go?

Mr. McLURE.—My understanding was that in case of emergency I was to report to Mr. Cooper by wire if possible.

Mr. HOLGATE.—First?

Mr. McLURE.—Yes.

Mr. HOLGATE.—The first report was to Mr. Cooper?

Mr. McLURE.—Yes.

Mr. HOLGATE.—And then you would wait to act until you got instructions from Mr. Cooper?

Mr. McLURE.—I had no authority to act without instructions either from him or Mr. Hoare.

Mr. HOLGATE.—Then you would report to Mr. Hoare?

Mr. McLURE.—Yes, sir, at the same time.

Mr. HOLGATE.—And you would act on instructions then from either of them?

Mr. McLURE.—Yes, sir.

Mr. HOLGATE.—Whichever came first?

Mr. McLURE.—Yes, sir.

Mr. HOLGATE.—Then with regard to your general inspection of the work on the structure as it progressed——

Mr. McLURE.—Inspection in what direction?

Mr. HOLGATE.—Not only of the work actually being done, but of the partly completed portions of the work; was that periodical or regular?

Mr. McLURE.—No, not at regular intervals, almost daily. I might miss a day once in a while, but very few days I was not over most of the bridge.

Mr. HOLGATE.—On track level?

Mr. McLURE.—No, on top chord and bottom chord, transverse struts and everywhere.

Prof. KERRY.—Did you keep any record of these inspections?

Mr. McLURE.—Not unless I found something that it was necessary to report.

Prof. KERRY.—Just in case there was something that you——

Mr. McLURE.—Yes, sir.

Prof. KERRY.—And it was part of your duty to keep the entire structure under observation in that way?

Mr. McLURE.—I understood so.

Prof. KERRY.—In those inspections were you sometimes accompanied by Mr. Birks?

Mr. McLURE.—Yes, I think so. Part of the way, anyway.

Prof. KERRY.—But not frequently?

Mr. McLURE.—Not frequently, no.

Mr. HOLGATE.—Now, you were on that work a long time, and there was Mr. Birks, Mr. Yenser, Mr. Cudworth, Mr. Kinloch and yourself together; you might just give me an idea what sort of a spirit existed amongst you all, was it a spirit of co-operation or was there antagonism?

Mr. McLURE.—No, it was entirely a spirit of co-operation; everybody was working to make a success of the bridge.

Mr. HOLGATE.—And that condition, was it continuous?

Mr. McLURE.—Absolutely. Of course, there were minor differences of opinion occasionally in discussions, but I am speaking in general.

Mr. HOLGATE.—I am speaking of the spirit, the prevailing spirit?

Mr. McLURE.—Yes, sir; it was entirely as I said, with a view to making a success of the bridge.

Mr. HOLGATE.—So that there was no bad feeling between those responsible on the work that might have probably on some conditions prevented work being carried on satisfactorily; that does not exist?

Mr. McLURE.—Does not exist at all.

The witness retired.

The Commission adjourned until to-morrow (Wednesday) morning at 10 o'clock.

THIRD DAY.

QUEBEC, WEDNESDAY, September 11, 1907.

The Commission resumed at 10 o'clock this morning.

ULRIC BARTHE recalled. He said:

After the Quebec Bridge Company was reorganized in 1897, a general plan was prepared by its chief engineer showing the location of the piers at the Chaudière site. This plan was submitted to the Dominion government and approved by the Railway Committee of the Privy Council, and also by the Governor General in Council. I produce, as Exhibit No. 2, the approval of the Railway Committee of the Privy Council and a copy of the Order in Council.

(Document produced, filed and marked as Exhibit No. 2.)

I produce, as Exhibit No. 3, the plan so prepared and approved.

(Document produced, filed and marked as Exhibit No. 3.)

I produce, as Exhibit No. 4, extracts from the minutes of meetings of the board of directors of the Quebec Bridge Company relating to the calling for tenders.

(Document produced, filed and marked as Exhibit No. 4.)

The specifications on which tenders were called for were submitted to the Department of Railways and Canals at Ottawa and were approved, and I produce, as Exhibit No. 5, the approval of the deputy minister.

(Document produced, filed and marked as Exhibit No. 5.)

A circular letter calling for tenders was issued, and I now produce the original draft of such letter, with form of tender attached, as No. 6.

(Document produced, filed and marked as Exhibit No. 6).

Accompanying the circular letter were specifications which I believe to be exactly similar to the schedules 'A' and 'A-1' annexed to the subsidy agreement between the Crown and the Quebec Bridge company under date November 12, 1900, which is filed as Exhibit No. 12 (document produced, filed and marked as Exhibit No. 12), save that the printed figures '1,000' on the first page of Schedule 'A-1' were corrected to '1,600'; and also a specification for a suspension bridge, copy of which is filed as Exhibit No. 7.

(Document produced, filed and marked as Exhibit No. 7).

I produce the tender received from the Phœnix Bridge company and file it as Exhibit No. 8.

(Document produced, filed and marked as Exhibit No. 8.)

The tenders for both substructure and superstructure were submitted to Mr. Theodore Cooper, consulting engineer of New York, who had been retained as such by resolution of the Board, of date March 23, 1899, and on June 23, 1890, Mr. Cooper reported, and I file his original report as Exhibit No. 9.

(Document produced, filed and marked as Exhibit No. 9).

On June 29, 1899, the Board ordered that Mr. Cooper's report together with the Phœnix Bridge Co.'s tender and Wm. Davis and Sons' tender, and that of the Keystone Co. for the substructure and the plans be sent to the Prime Minister at Ottawa, which was done, and I produce a copy of the resolution of the Board of directors as Exhibit No. 10.

(Document produced, filed and marked as Exhibit No. 10).

I find among the minutes of the company a report from Mr. Theodore Cooper, consulting engineer, of date May 1, 1900 which I now file as Exhibit No. 11.

(Document produced, filed and marked as Exhibit No. 11).

On November 12, 1900, a subsidy agreement was executed between the Crown and the Quebec Bridge Company, and I now file as Exhibit No. 12, this agreement, to which are annexed as schedules 'A' and 'A-1 the specifications, copies of which were sent out with a circular letter inviting tenders. I note, however, that in the specification marked 'Schedule A-1' the length of the span, originally printed at 1,000 feet, has been altered to 1,800 feet in red ink. In the original specifications sent out inviting tenders the length of the suspended span was stated to be 1,600 feet.

(Document produced, filed and marked as Exhibit No. 12).

On December 19, 1900, contracts for the two approach spans were executed between the Quebec Bridge Company and the Phœnix Bridge Company, and these are filed as Exhibits Nos. 13 and 14.

(Documents produced, filed and marked as Exhibits Nos. 13 and 14.)

On January 17, 1901, the board passed a resolution approving the contracts previously executed which had been filed as Exhibits 13 and 14, and a copy of this minute is filed as Exhibit No. 15.

(Document produced, filed, and marked as Exhibit No. 15).

On June 19, 1903, a contract was executed between the two companies for the construction of the superstructure, and I now produce the original contract as Exhibit No. 16. It appears from the contract that there were plans and specifications annexed to the contract and forming part thereof, but those I have not been able to find up to the present time. I shall make further search and if I am able to find either or both plans and specifications, will produce them.

(Document produced, filed and marked as Exhibit No. 16).

On July 21, 1903 an Order in Council was passed, giving authority to Mr. Cooper to make some modifications in plans and specifications and a copy of this is filed and marked as Exhibit No. 17.

(Document produced, filed and marked as Exhibit No. 17).

On August 15, 1903, a further Order in Council was passed with respect to the powers and duties of the chief engineer, and a copy of this I file as Exhibit No. 18.

(Document produced, filed and marked as Exhibit No. 18).

I was asked to produce copies of all the annual reports of the directors of the Quebec Bridge Co. from 1897 to 1907 inclusive, and I now produce them as Exhibit No. 19.

(Document produced, filed and marked as Exhibit No. 19).

I was asked to produce the resolutions of the board of directors defining the position of Mr. Theodore Cooper as consulting engineer and I now produce copies of all such resolutions and file them as Exhibit 20.

(Document produced, filed and marked as Exhibit No. 20).

Mr. HOLGATE.—You are to produce letters between Mr. Cooper and the company?

Mr. BARTHE.—I have produced a resolution referring to the letters. I will produce the letters.

Mr. HOLGATE.—Yes, we want the letters themselves. We want the correspondence from and to Mr. Cooper relating to this matter.

Mr. STUART.—Do you mean relating to the whole thing or simply to his appointment?

Mr. HOLGATE.—In the meantime just to his appointment. We note that the specifications and plans connected with the contract with the Phœnix Bridge Company are not produced. These are necessary, and they must be produced; so we would ask you to take steps to locate them and bring them here.

Mr. BARTHE.—I will do whatever is possible.

Mr. HOLGATE.—Are there any other documents in the way of contracts or agreements that you are aware of connected with this matter, either with the city of Quebec or the province of Quebec?

Mr. BARTHE.—I do not know; I will see. I do not remember them.

Mr. HOLGATE.—If there are any of these documents, we would ask you to let us have them.

Mr. BARTHE.—Yes.

Commission took recess.

AFTERNOON SESSION—THIRD DAY.

Commission resumed at two o'clock.

EDWARD A. HOARE, sworn.

Mr. HOLGATE.—Will you please state what your position is in connection with the Quebec Bridge Company?

Mr. HOARE.—Chief Engineer of the Quebec Bridge and Railway Company.

Mr. HOLGATE.—By whom were you appointed?

Mr. HOARE.—The directors of the Quebec Bridge and Railway Company.

Mr. HOLGATE.—Do you remember the date?

Mr. HOARE.—In 1898 I was first employed on the first surveys, and so forth, and that class of work, and in 1900 an agreement was made for the continuation of my appointment till the completion of the work in connection with the bridge and the railway connections.

Mr. HOLGATE.—Were these appointments made only through the resolution of the board?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Have you been continuously acting in that capacity?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Up to the present time?

Mr. HOARE.—Up to the present time.

Mr. HOLGATE.—Previous to your appointment, Mr. Hoare, will you give us an idea of your experience?

Mr. HOARE.—I have been employed for about 35 years in various works—railways in Ontario, government railways, several railways for private corporations, marine work and some waterworks.

Mr. HOLGATE.—You might be specific as to those if you can.

Mr. HOARE.—Name the different railways?

Mr. HOLGATE.—Yes.

Mr. HOARE.—The Great Western Railway.

Mr. HOLGATE.—With the periods.

Mr. HOARE.—I do not remember the dates.

Mr. HOLGATE.—As nearly as you can.

Mr. HOARE.—I could not remember them. I would have to refer back. My career extends over a period of about 35 years in Canada—on the Toronto, Gray & Bruce railway, which was my first employment out here; on the Wellington, Grey & Bruce; Wellington, Huron & Bruce; Great Western Railway of Canada (that is now the Grand Trunk); then the Provincial Government Railways for the province of Quebec now operated by the Canadian Pacific Railway Company; the Great Northern Railway; the Quebec & Lake St. John railway and several minor railways; part of the time in private practice and part of the time waterworks construction. I think that covers the majority. I cannot specify the dates; I can only generalize and say that it extended over a period of 30 or 35 years.

Mr. HOLGATE.—By reference, Mr. Hoare, I suppose you can get these dates thoroughly definite, can you not,

Mr. HOARE.—I think I can. I could not get them absolutely correct, but I can give you some dates in any case.

Mr. HOLGATE.—If you could get some definite dates on these matters I think it would be better.

Mr. HOARE.—Very well, I will try.

Mr. HOLGATE.—Could you get them in chronological order—the names of the railways and corporations that you were with?

Mr. HOARE.—Yes, I can get them in chronological order.

Mr. HOLGATE.—And the position you occupied in each case?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And the length of time you were with each?

Mr. HOARE.—Yes, I can get that.

Mr. HOLGATE.—Especially in connection with bridge construction, what works had you in hand?

Mr. HOARE.—Just the bridges that one might have on railway work. The general run of bridges you have on railway work.

Mr. HOLGATE.—What class of bridges would that be?

Mr. HOARE.—Wooden trusses, steel trusses, girder work up to spans, I should say, of about 300 feet including the bridge over the Ottawa at Hawkesbury for the Great Northern Railway Company.

Mr. HOLGATE.—Any other special structures?

Mr. HOARE.—Nothing special. There were several large structures.

Mr. HOLGATE.—Which was the largest?

Mr. HOARE.—The Hawkesbury bridge, I think, is about the largest.

Mr. HOLGATE.—You might give us a description of the bridge.

Mr. HOARE.—It was not the largest span but it was the longest bridge. It was the most important I think. There were seven spans of 210 feet across the Long Sault Rapids at Hawksbury and a bridge over the canal close at one end of it and a long timber viaduct, from memory, about 2,000 feet long. The bridge was about 50

feet above the river level, the piers were of masonry, about 12 feet of water and very swift current. That is the general description from memory.

Mr. HOLGATE.—These spans were 210 feet?

Mr. HOARE.—About 210 feet.

Mr. HOLGATE.—You have built some spans longer than 210 feet?

Mr. HOARE.—300 is the maximum.

Mr. HOLGATE.—Which bridge was that?

Mr. HOARE.—It was between 250 and 300 feet. That is on the same railway at Lachute.

Mr. HOLGATE.—Were these bridges for single or double track?

Mr. HOARE.—Single. There is one example I might mention which is quite a considerable structure—the double track bridge over the Chaudiere about 2,000 feet from the east end of the bridge over the St. Lawrence. It is a double track bridge, two spans of 200 feet, a span of 180 feet, a span of 100 feet and about 140 feet high.

Mr. HOLGATE.—When was that built?

Mr. HOARE.—That was completed in the early part of 1905 to the best of my memory.

Mr. HOLGATE.—Was that done in connection with your duties as engineer of the Quebec Bridge and Railway Company?

Mr. HOARE.—Quebec Bridge and Railway Company, that was part of my duty.

Mr. HOLGATE.—What position had you on the Great Northern?

Mr. HOARE.—Chief engineer of the railway company.

Mr. HOLGATE.—What connection had you personally with these bridges on the Great Northern?

Mr. HOARE.—I had to make the plans and specifications and see the work carried out. The details of these structures, of course, as usual, were made by the sub-contractors for the superstructure.

Mr. HOLGATE.—Who were they?

Mr. HOARE.—The Hamilton Bridge Company.

Prof. KERRY.—Was not the Great Northern Railway built under one general contract by contractors who took the entire responsibility?

Mr. HOARE,—Yes, the whole line was let to a firm of contractors on the specifications and plans prepared by the Great Northern Railway Company.

Prof. KERRY.—These were just simply general specifications?

Mr. HOARE.—No, they were detailed specifications covering every class of work on the road.

Prof. KERRY.—But the contractors took the entire responsibility, starting even from the location, subject only to approval?

Mr. HOARE.—No; the only part of the road not located was the section between Lachute and Grenville. The rest was all located; they had to complete that portion of the location subject to my approval. In other words they furnished the engineers to do the actual surveying but under my direction.

Mr. HOLGATE.—Then I understand that leads up to the viaduct connected with it?

Mr. HOARE.—That is about the last work I had before I was employed by the Quebec Bridge and Railway Company.

Mr. HOLGATE.—As chief engineer of the Quebec Bridge and Railway Company, what are your powers?

Mr. HOARE.—To take general charge of the work.

Mr. HOLGATE.—By that you mean the work itself?

Mr. HOARE.—Yes, to undertake the duties generally undertaken by the engineer for a company; that is, to make the surveys for the work, plans, specifications, the latter to a limited extent, prepare for contracts and see the work carried out, and to make progress estimates for payments to contractors.

Mr. HOLGATE.—That is in regard to all the company's operations?

Mr. HOARE.—Yes.

Mr. HOLGATE.—The bridge over the St. Lawrence river was then a portion of a vast undertaking?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And in connection with that superstructure, what were your particular duties?

Mr. HOARE.—My first duty was to make a survey of the bridge site, take soundings and borings, locate the position of the bridge and the piers, and to have the general outline plans approved by the Department of Railways and Canals at Ottawa.

Mr. HOLGATE.—Were you required to certify to these plans before they were approved by the Department of Railways and Canals?

Mr. HOARE.—I do not remember that. I think I did certify them, but I do not know whether I was required to or not. I do not know whether it was an absolute necessity. I think I did.

Prof. KERRY.—Those were the usual preliminary plans, setting forth the span and the clearance above the waterway?

Mr. HOARE.—Yes, precisely.

Mr. HOLGATE.—Yes, Mr. Hoare?

Mr. HOARE.—After these plans were approved, establishing the minimum waterway——

Mr. HOLGATE.—How much was that?

Mr. HOARE.—1,600 feet of a minimum clearance for vessels. Tenders then were called for the bridge over the River St. Lawrence.

Mr. HOLGATE.—For the piers?

Mr. HOARE.—For all—for the superstructure and the substructure at the same time.

Mr. HOLGATE.—Prior to that, specifications would be prepared?

Mr. HOARE.—Yes, specifications were prepared, or specifications were prepared in connection with all these plans I have referred to.

Prof. KERRY.—Were the tenderers permitted to tender upon their own plans, Mr. Hoare, as far as structural outline went?

Mr. HOARE.—Yes, subject to the span, the clearance for vessels in both directions and the defined rail level.

Mr. HOLGATE.—What was the result of the inquiry for these tenders?

Mr. HOARE.—We got tenders from four corporations. The Phœnix Bridge Company submitted designs and tenders for two classes of bridge—for a cantilever and suspension bridge, superstructure and substructure, both inclusive. The Keystone Bridge Company, the Union Bridge Company and the Dominion Bridge Company, all submitted plans for both superstructure and substructure. I will not be positive whether these three latter companies submitted suspension designs or not, but I believe the Keystone and Union Bridge Companies did submit plans for both classes of bridging.

Mr. HOLGATE.—What was done with these submitted plans and propositions?

Mr. HOARE.—They were all referred to Mr. Cooper.

Mr. HOLGATE.—Under what circumstances were they referred to Mr. Cooper?

Mr. HOARE.—By order of the board.

Mr. HOLGATE.—In what capacity did Mr. Cooper act?

Mr. HOARE.—Consulting engineer.

Mr. HOLGATE.—Appointed by the board?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—These plans were submitted to him for his report?

Mr. HOARE.—To be analyzed and to be reported upon.

Mr. HOLGATE.—What was his report?

Mr. HOARE.—He recommended the acceptance of the Phœnix Bridge Company's cantilever span.

Mr. HOLGATE.—What was the length of the span?

Mr. HOARE.—1,600 feet—channel span.

Mr. HOLGATE.—What was the next step taken by the company?

Mr. HOARE.—The next important step was the contract entered into with Phœnix Bridge Company.

Mr. HOLGATE.—Was that on the basis of their proposal?

Mr. HOARE.—Yes.

Mr. HOLGATE.—The same dimensions for the bridge were adhered to?

Mr. HOARE.—Yes.

Mr. HOLGATE.—1,600 feet?

Mr. HOARE.—Yes. No, pardon me; before a contract was actually signed the span was changed.

Mr. HOLGATE.—To?

Mr. HOARE.—1,800 feet.

Mr. HOLGATE.—This contract was on the basis of——?

Mr. HOARE.—The tenders were on the basis of 1,600 feet and the contract was on the basis of 1,800 feet for the channel span.

Mr. HOLGATE.—What comprised that contract? Were there plans and specifications attached?

Mr. HOARE.—You mean submitted by the Phœnix Bridge Company.

Mr. HOLGATE.—No, when that contract was made.

Mr. HOARE.—There were general specifications attached and a general outline plan showing the position of the piers, the rail level and the channel clearance to comply with the Government regulations.

Mr. HOLGATE.—Who drew these specifications?

Mr. HOARE.—I did.

Mr. HOLGATE.—Were they submitted to Mr. Cooper?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And received his approval?

Mr. HOARE.—With modifications. There were some changes made later.

Mr. HOLGATE.—By Mr. Cooper?

Mr. HOARE.—Yes.

Mr. HOLGATE.—I am speaking now only of the specifications that were attached to the signed contract.

Mr. HOARE.—No, they were not changed. The only change in the original was in the figures representing the channel span.

Mr. HOLGATE.—Then these specifications were approved by Mr. Cooper?

Mr. HOARE.—No, not prior to that time. I do not remember any noted approval on these specifications. These specifications were approved by the Department of Railways and Canals earlier.

Mr. STUART.—I think the specifications were the same which were submitted to Mr. Cooper and his approval of them was contained in his recommendation that the tender should be accepted.

Mr. HOLGATE.—Were these specifications the same that were attached to Mr. Cooper's report on the tenders?

Mr. HOARE.—Yes, precisely.

Mr. HOLGATE.—Did those specifications cover the construction of a 1,600 foot bridge or an 1,800 foot bridge?

Mr. HOARE.—They applied to both.

Mr. HOLGATE.—How do you know?

Mr. HOARE.—The specifications as first drawn were for a 1,600 foot channel span. The advertisement calling for bids called for the 1,600 feet mentioned in the specification, but when the specification was embodied in the order in council—that is in connection with the subsidy contract—the same specification was used but an 1,800 foot span was referred to. They simply changed the figures from one channel span to

another. The same specification was used. There is no change in the clause of the specification. In other words, that specification was used for all documents until Mr. Cooper suggested certain modifications about the time the Phœnix Bridge Company's contract was going to be signed.

Mr. HOLGATE.—I am not clear in my mind yet, Mr. Hoare, that Mr. Cooper approved the specification that formed part of your contract with the Phœnix Bridge Company.

Mr. HOARE.—I do not think he actually signed these specifications.

Mr. STUART.—Probably his report might speak of them? If the same specifications formed part of the contract the report would speak of them, I think.

Mr. HOLGATE.—Perhaps at this point it would be fair to get Mr. Hoare to look at these papers. (Mr. Hoare examined Mr. Cooper's report.)

Mr. HOARE.—He refers to the specifications here. Those are the original specifications that were issued for tenders and attached to the subsidy contract. Those are the tenders referred to in this report. Those are the same specifications.

Mr. HOLGATE.—The specifications in the subsidy contract—are they the same specifications as were in the contract between the Quebec Bridge and Railway Company and the Phœnix Bridge Company?

Mr. HOARE.—Yes, the same thing.

Mr. HOLGATE.—Identically?

Mr. HOARE.—Yes.

Mr. HOLGATE.—What does Mr. Cooper say about that? This is his report of what date?

Mr. HOARE.—(Reading) 'Both the Keystone and Phœnix plans of cantilever superstructure are in accordance with specifications and are acceptable designs.' The specifications here referred to are the specifiations that were issued for tenders and the same which formed part of the subsidy contract. They were approved by the Department of Railways and Canals. Then, after that, when the Phœnix Bridge Company signed their contract, it was understood that limited modifications were to be made in these specifications and they were then from time to time as the work proceeded.

Mr. HOLGATE.—Was that contract made at that time with the Phœnix Bridge Company?

Mr. HOARE.—At the date of this report?

Mr. HOLGATE.—Yes.

Mr. HOARE.—No, a long time after that.

Mr. HOLGATE.—Was the contract made then before these alterations were suggested in the specifications?

Mr. HOARE.—Yes, to the best of my knowledge; as far as I can remember the contract was actually signed before the modifications were made. They were made immediately afterwards, but previous to any work actually being performed or any detail plans made by the Phœnix Bridge Company, the modifications were prepared and given to the Phœnix Bridge Company before they undertook any detailing work.

Mr. HOLGATE.—What bridge span did the contract call for?

Mr. HOARE.—An 1,800 foot channel span.

Mr. HOLGATE.—What were these changes that were made in that specification subsequent to the signing of the contract?

Mr. HOARE.—These modifications in the specification were made after the signing of the contract but previous to any detail plans being commenced or work commenced by the Phœnix Bridge Company. It was understood that modifications would be made and that they were not to proceed with the work until these modifications were outlined. There is a letter attached to the contract of the Phœnix Bridge Co., which will throw some light on that matter if you will just refer to it. (Exhibit No. 16.)

Prof. GALBRAITH.—Is that the letter to Mr. Parent?

Mr. HOARE.—Yes, signed by Mr. Reeves.

'As soon as the revised specifications have been furnished to us, approved by the government engineers.'

Mr. STUART.—What is the date of that letter?

Mr. HOLGATE.—June 19th, 1903.

Mr. HOARE.—That letter, I think, will enlighten you a little on that.

Mr. HOLGATE.—What were these revised specifications?

Prof. KERRY.—Do we understand that the Phœnix Bridge Company took a contract with specifications attached on an understanding that these specifications were to be altered by the representatives of the Quebec Bridge and Railway Co.?

Mr. HOARE.—Yes, that was the general understanding.

Prof. KERRY.—Is that expressed in writing clearly anywhere? I am familiar with Mr. Reeves' letter to Mr. Parent.

Mr. HOARE.—I am not positive about that.

Mr. HOLGATE.—Where can we secure the original of this specification that was attached to the contract and the plans that formed part of the contract?

Mr. HOARE.—They should be with the contract in the secretary's charge in the safe, but as shown this morning, they were disconnected.

Mr. HOLGATE.—We have asked the secretary and he does not know where they are. Where else could they be?

Mr. HOARE.—They might have got up to Ottawa by mistake. He sent a lot up there, and they may have got up with them. They will have to be traced up.

Mr. HOLGATE.—Can you give us any information?

Mr. HOARE.—I have not seen them for years. I have not seen them since I distributed these different plans and specifications calling for tenders and attached to the contract. I have never seen them since.

Prof. KERRY.—Were the plans and specifications attached to the contract duplicates of the general plan and specification sent out with the call for tenders?

Mr. HOARE.—Yes.

Mr. HOLGATE.—For your own use in connection with this work, Mr. Hoare, what documents had you?

Mr. HOARE.—The original and the amended specifications.

(Document filed and marked exhibit No. 21.)

Mr. HOLGATE.—You identify exhibit No. 21 as a copy of the specifications that were attached to the contract and also the copies of the amendments to the specifications that were afterwards inserted?

Mr. HOARE.—Yes.

Mr. HOLGATE.—In what way did the Phœnix Bridge Company assent to these modified specifications?

Mr. HOARE.—They agreed to accept these modifications, and I think Mr. Reeves' letter there refers to it. It is virtually an acceptance of them as well—that letter attached to the contract.

Mr. STUART.—May I see the letter?

Mr. HOLGATE.—Yes. I would like to know at this point whether——

Mr. STUART.—Whether we are agreed that these are the modified specifications?

Mr. HOLGATE.—Yes.

Mr. HOARE.—I am certain that is all; positive.

Mr. STUART.—Mr. Deans' impression is that that is all, but of course he would not like to speak of a matter of that importance without verifying it. I think we can be tolerably sure that Mr. Hoare is right when he says so.

Mr. HOLGATE.—Who prepared these amendments to the specifications that you refer to, exhibit 21?

Mr. HOARE.—Mr. Cooper.

Mr. HOLGATE.—Were these amendments approved by the government engineers?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—What date was that, do you remember?

Mr. Hoare.—No, I cannot tell you now, but I think it must be in—there must be a letter or some reference to it in Mr. Barthe's exhibits; it must be covered by all those documents.

Prof. Kennedy.—When and by whom was the advisability of these amendments suggested?

Mr. Hoare.—I could not give you the exact date when they were advised, but it was upon the advice of Mr. Cooper that these amendments were submitted to the Department of Railways and Canals for approval, which were accepted.

Prof. Kennedy.—Mr. Cooper's suggestions will be in writing?

Mr. Hoare.—They should be, no doubt they are; no doubt there is a letter to that effect. I rather think there is some reference to that in those documents also, those exhibits of this morning.

Mr. Holgate. Who was the representative of the Department of Railways and Canals who would deal with the matter at that time?

Mr. Hoare.—Mr. Schreiber.

Mr. Holgate.—Mr. Collingwood Schreiber?

Mr. Hoare.—Yes.

Mr. Holgate.—Just look over that document (exhibit No. 17) and see if that gives you any light on the matter, Mr. Hoare?

Mr. Hoare.—This refers directly to those amendments. This is the communication that leads up to that. That is the report to sanction the amendments proposed there. (Extract from Order in Council, July 23, 1903.)

Mr. Holgate. What gave rise, Mr. Hoare, to the suggestions made by Mr. Cooper for the modification of the original specification?

Mr. Hoare.—He considered general improvements were necessary.

Mr. Holgate. He considered it?

Mr. Hoare.—Yes, he considered that some improvements were required and necessary in some clauses of the specifications before the details were commenced by the Phœnix Bridge Co. before they commenced their detailed plans.

Mr. Holgate.—Did he draw up the original specifications that were made a basis for the general competition?

Mr. Hoare. No.

Mr. Holgate.—Who did?

Mr. Hoare.—I did. To explain the matter a little more fully, there were a few suggestions of my own in that specification, but the majority of the changes were his own. I do not know that I could give all the specified reasons; I know with regard to one of the clauses, for wind stresses, he thought mine were unnecessarily heavy in the original specification; he gave that as one reason, that I had provided for too heavy wind pressure.

Mr. Holgate. Had you and Mr. Cooper conferences prior to June 2, 1903?

Mr. Hoare.—Yes, we had several.

Mr. Holgate. And were Mr. Cooper's amendments to the specification the outcome of these conferences?

Mr. Hoare. To a certain extent, not altogether.

Mr. Holgate.—And at that time Mr. Cooper was the official consulting engineer for your company?

Mr. Hoare. Yes, sir.

Mr. Holgate. And you submitted these questions to him? Was it necessary, in your opinion, to get his approval before they were put into contract form?

Mr. Hoare. Yes.

Mr. Holgate.—And when these specifications were amended, were they final?

Mr. Hoare. Yes, as far as original specifications are concerned, that is all that I have any knowledge of.

Mr. Holgate. And were they accepted by the Phœnix Bridge Company as complete?

Mr. HOARE.—I imagine so; I heard nothing to the contrary.

Mr. HOLGATE.—If there had been anything to the contrary you would have known it?

Mr. HOARE.—Yes, most certainly.

Mr. HOLGATE.—Were there any further specifications in connection with the work made that would amend in any way these specifications?

Mr. HOARE.—Not to my knowledge.

Mr. HOLGATE.—I would like that a definite answer if you can make it.

Mr. HOARE.—Will you repeat the question?

Question read to witness as follows:—

'Were there any further specifications in connection with the work made that would amend in any way these specifications?'

Mr. HOARE.—I am only speaking from personal knowledge; I am not aware of any. We have none on record. I do not think it is possible, but——

Mr. HOLGATE.—There must have been a finality somewhere, where was it? Were these final?

Mr. HOARE.—Yes, those are final as far as written specifications go, as far as written specifications, written or printed specifications go.

Mr. HOLGATE.—That is Exhibit No. 21.

Mr. HOARE.—But Mr. Cooper he always considered that he had the right to make any—probably they do not come under the head of specifications, but he had the right to make changes in detail from time to time as plans were submitted by the Phœnix Bridge Company ; that hardly perhaps comes under that heading.

Mr. HOLGATE.—But as far as documentary evidence goes, this was the last ?

Mr. HOARE.—That is the last.

Mr. HOLGATE.—I only referred to specifications.

Mr. HOARE.—That is the last.

Mr. HOLGATE.—And you feel sure in your own mind that this copy agrees with the one that was certified by the government engineer ?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—Now that was your connection with the contract, Mr. Hoare ?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—With regard to the carrying out of that contract what were your powers ? Are your powers clearly defined in the contract ?

Mr. HOARE.—In the contract with the Phœnix Bridge Company ?

Mr. HOLGATE.—In the contract with the Phœnix Bridge Company ?

Mr. HOARE.—Let me refer to it a minute, I have not read it for a long time. Yes, the specification governs my powers pretty well ; it specifies——

Mr. HOLGATE.—You mean the contract specifies your powers ?

Mr. HOARE.—Yes, the contract of the 19th of June.

Mr. HOLGATE.—Who is the engineer of the Quebec Bridge and Railway Company mentioned in this contract ?

Mr. HOARE.—Myself.

Mr. HOLGATE.—And who is the consulting engineer?

Mr. HOARE.—Mr. Theodore Cooper.

Mr. HOLGATE.—And at the time that this was made who was the Deputy Minister and Chief Engineer of the Department of Railways and Canals ?

Mr. HOARE.—Mr. Collingwood Schreiber.

Mr. HOLGATE.—Were there any duties that you had in connection with this contract, Mr. Hoare, outside of what are specified in the contract or does the contract fully cover them.

Mr. HOARE.—Oh, I think the contract, yes, I should say the contract fully covers them.

Mr. HOLGATE.—We would like to have you just give us a short description of the

organization that you used in the carrying out of this contract, beginning with your connection with Mr. Cooper as consulting engineer ?

Mr. HOARE.—Mr. Cooper was consulting engineer, resident in New York.

Mr. HOLGATE.—Did he come here to consult you or did you go there to consult him.

Mr. HOARE.—I went there to consult him generally. You are speaking now in connection with the superstructure or the whole work ?

Mr. HOLGATE.—Any time.

Mr. HOARE.—He came here during the construction of the foundations, he came here on two or three occasions. For the superstructure, I went to New York.

Mr. HOLGATE.—Do you remember the date of Mr. Cooper's last visit ?

Mr. HOARE.—No, I do not at present. I can give it to you roughly, I think about three years ago, three or four years ago.

Mr. HOLGATE.—The last visit ?

Mr. HOARE.—Yes, he was here on three occasions during the sinking of the caissons for the bridge foundation. I do not think he has been here since, but he received weekly reports.

Mr. HOLGATE.—You had a system of——

Mr. HOARE.—We had a system of weekly reports.

Mr. HOLGATE.—Who made these reports ?

Mr. HOARE.—Mr. McLure.

Mr. HOLGATE.—Who is Mr. McLure ?

Mr. HOARE.—Inspecting engineer on the erection.

Mr. HOLGATE.—By whom was he appointed ?

Mr. HOARE.—Jointly, by mutual agreement between Mr. Cooper and myself.

Mr. HOLGATE.—To whom does he report ?

Mr. HOARE.—Both of us, and Mr. Cooper's communication with the bridge was maintained through Mr. McLure's weekly reports.

Prof. KERRY.—What was your knowledge of Mr. McLure that made you make that selection, Mr. Hoare ?

Mr. HOARE.—Previous to his engagement I could not find anybody suitable for that position and I left it entirely to Mr. Cooper. I left it entirely to him, and he nominated Mr. McLure to the position. I had previous authority from the Bridge Company to arrange personally or mutually with Mr. Cooper for any inspectors wanted for that work.

Prof. KERRY.—Then in the selection of Mr. McLure you felt that you had fully provided for all necessary inspection ?

Mr. HOARE.—No, there are other inspectors besides. On the erection Mr. Kinloch was appointed.

Prof. KERRY.—But the appointment of Mr. McLure and Mr. Kinloch was your carrying out of the instructions or the commission of the board of directors to organize fully a competent inspection ?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Could you have dismissed Mr. McLure, Mr. Hoare ?

Mr. HOARE.—I could have, but I would not have done it without coming to an agreement with Mr. Cooper.

Mr. HOLGATE.—Could Mr. Cooper have dismissed him without coming to an agreement with you?

Mr. HOARE.—No, I do not think he could, because he would not have done so. I do not think he would have done so, but it is doubtful whether he could.

Mr. HOLGATE.—You mentioned, I think, another name?

Mr. HOARE.—Mr. Kinloch, on the erection.

Mr. HOLGATE.—Now, would you tell us what Mr. McLure's duties were. You have already put it in the form of a letter dated September 7, 1907 (document produced, filed and marked as Exhibit No. 22) see if that correctly describes his duties?

Mr. HOARE.—Yes. In addition to what I have stated here, if there was anything of importance occurred he had always orders to telegraph immediately to Mr. Cooper for advice on any question of importance or emergency, in addition to what I have stated there, but that generally covers, I think, his duty.

Mr. HOLGATE.—Then does this letter also cover a description of Mr. Kinloch's duties?

Mr. HOARE.—Yes, I should have said to him or to me, but that substantially covers his duties.

Mr. HOLGATE.—'To Mr. McLure or to me.'

Mr. HOARE.—Yes, or to me.

Mr. HOLGATE.—Then I understand that you had some further inspectors at the works where the superstructure was fabricated?

Mr. HOARE.—Yes.

Mr. HOLGATE.—You might give us those names.

Mr. HOARE.—At Phœnixville, Mr. Edwards and Mr. Meeser.

Mr. HOLGATE.—And their duties were what?

Mr. HOARE.—And Mr. Keenan. He was mill inspector at Harrisburg; and there were others employed from time to time as mill inspectors as required, and their services dispensed with when the work at that particular mill was completed. The only two of those inspectors employed at the present time are Mr. Edwards and Mr. Meeser. Mr. Edwards is chief inspector, and Mr. Meeser is his assistant. Their duties are, to inspect the shop work and mill work at Phœnixville. Beyond that Mr. Edwards duties are to keep strict account of the metal delivered from outside mills to be fabricated at the Phœnixville shops, and all metal shipped from there to Quebec; to make returns to me of the quantities of metal rolled, fabricated and shipped, at regular intervals. He had also to furnish me with detailed reports of all metal inspected at the mills as well as at the shops, also chemical tests of metal in the different melts at the scale works. Besides the ordinary specimen tests required from time to time they were instructed to make full size eye-bar tests to destruction. About two per cent of the total number of eye-bars in the structure were tested in this manner.

Mr. HOLGATE.—Are there full reports of all these tests in existence?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Can they be produced here?

Mr. HOARE.—I can produce them.

Mr. HOLGATE.—Then we would require these two inspectors?

Mr. HOARE.—They will be here on Thursday, I sent for them.

Mr. HOLGATE.—Were these tests demanded by the contract?

Mr. HOARE.—Yes—no, demanded by the specifications more strictly speaking.

Mr. HOLGATE.—Well, of course by the specifications.

Mr. HOARE.—By the specifications, yes.

Mr. HOLGATE.—And were all these tests made in accordance with the demands of the specifications?

Mr. HOARE.—I think they were exceeded.

Mr. HOLGATE.—And were there tests made beyond what the specifications called for?

Mr. HOARE.—I think so. If any departure was made it was in excess of the requirement of the specification.

Mr. HOLGATE.—But we will get full details of that from the inspectors?

Mr. HOARE.—You will get full details of that from the inspectors.

Mr. HOLGATE.—Now, with regard to Mr. McLure, you state that Mr. McLure's duties were to thoroughly inspect all material which arrived at the storage yard from Phœnixville, before it was placed in the bridge, to check, with Mr. Birks, the dimensions of all members and to see that they were properly assembled according to erection plans before the erection foreman was allowed to place them in the bridge. Were those instructions, to your knowledge, carried out?

Mr. HOARE.—Yes, I believe they were thoroughly carried out in every particular.

Mr. HOLGATE.—Were these instructions given to Mr. McLure in writing?

Mr. HOARE.—I do not know that they were given in writing, word for word, to correspond with my letter, but he received very clear instructions from Mr. Cooper before he came here what his duties were.

Mr. HOLGATE.—Did you issue any instructions to Mr. McLure in writing?

Mr. HOARE.—No, sir, I considered Mr. Cooper's instructions quite sufficient.

Mr. HOLGATE.—Did you see the instructions, Mr. Hoare, that Mr. McLure received from Mr. Cooper?

Mr. HOARE.—Yes, sir, when he first came here I saw them.

Mr. HOLGATE.—There was a letter of instructions that Mr. McLure got from Mr. Cooper?

Mr. HOARE.—Yes, sir, and he showed it to me immediately on arrival.

Mr. HOLGATE.—In your opinion, Mr. Hoare, was it an important step to inspect all metal which arrived at the storage yard?

Mr. HOARE.—Yes, very.

Mr. HOLGATE.—Very important?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And you are quite sure that the inspection was carried out?

Mr. HOARE.—I am positive that those two gentlemen thoroughly carried out their instructions and duties in that respect.

Mr. HOLGATE.—Would this apply both to Mr. McLure and Mr. Kinloch?

Mr. HOARE.—Both, to both of them.

Mr. HOLGATE.—Then Mr. McLure, according to your understanding, Mr. Hoare had to, as part if his duty, check, with Mr. Birks, the dimensions of all members?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Where would that be done?

Mr. HOARE.—Generally speaking, before the metal is taken off the cars on the bridge. I said before the metal was lifted off the cars on the bridge to put it into position.

Mr. HOLGATE.—And that differs from his other inspection, which was, you understand, made in the yard?

Mr. HOARE.—Oh, they used to inspect at both places as necessity required, inspected the metal at both places, one or other of them would inspect the metal at both places.

Mr. HOLGATE.—But it was your understanding that the rule was all that should be inspected on arrival at the storage yard?

Mr. HOARE.—They possibly would not inspect every piece of metal, but every important piece of metal would be looked over on arrival to see if it had sustained any damage during transportation. The final inspection was made on the cars prior to the metal being hoisted into position, and they also checked over—not only inspected the metal to look out for defects, but to check with the erection plans to see that the proper members were assembled correctly, to see that the members were correctly assembled.

Mr. HOLGATE.—In all these matters, Mr. Hoare, are you speaking from your positive personal knowledge of what was done?

Mr. HOARE.—Personal knowledge.

Mr. HOLGATE.—Not simply from what instructions you gave, or someone else gave, of what was done?

Mr. HOARE.—Personal knowledge, what I know myself.

Prof. KERRY.—Do I understand that the dimensions of the members were actually checked by Mr. Birks and Mr. McLure together?

Mr. HOARE.—On the cars, yes.

Prof. KERRY.—On the cars?

Mr. HOARE.—Finally, before they were lifted into position.

Prof. KERRY.—That was the regulation practice?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Who would order the parts forward from the yard to the bridge?

Mr. HOARE.—The foreman of erection.

Mr. HOLGATE.—Of the Phœnix Bridge Company?

Mr. HOARE.—The Phœnix Bridge Company's foreman of erection would call for members in the yard as he required them.

Mr. HOLGATE.—But according to your system that would already have been inspected by the Quebec Bridge Company's inspector.

Mr. HOARE.—Yes, and then inspected again at the bridge before the members were lifted to position.

Mr. HOLGATE.—Mr. Kinloch then was appointed by yourself?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—And responsible to you?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—To you only?

Mr. HOARE.—To me only.

Mr. HOLGATE.—What was his relation then with Mr. McLure?

Mr. HOARE.—He assisted, he worked with Mr. McLure, inspecting mechanical parts of the bridge, riveted and so forth.

Mr. HOLGATE.—Mr. McLure's inspection then was more general than Mr. Kinloch's?

Mr. HOARE.—A little more general and his work was more technical and clerical. He had to look after technical questions that arose from time to time.

Mr. HOLGATE.—Was Mr. Kinloch's work principally on details?

Mr. HOARE.—Yes, detailed work; that is inspecting the metal generally before it went into the work, joints, riveting, bolting and so forth.

Mr. HOLGATE.—Under whose instructions would he work?

Mr. HOARE.—I gave him instructions from time to time and he always conferred with Mr. McLure, worked with him in fact and conferred with him from time to time, and if he discovered anything unnatural, anything out of the common, he would always mention it to Mr. McLure, and he would report the matter to myself and Mr. Cooper, and make his record of same. Mr. McLure kept all the records of the work, that is the daily diary of what occurred during a season's work.

Mr. HOLGATE.—Then, did Mr. Kinloch report to Mr. McLure?

Mr. HOARE.—Yes, they did not work independently. Anything he discovered in the work that Mr. McLure did not see, the first thing he would do would be to report to Mr. McLure, so it would be recorded and then it would come to me through Mr. McLure and to Mr. Cooper if necessary, to the Phœnix Bridge Company.

Mr. HOLGATE.—Through you to Mr. Cooper or through Mr. McLure to Mr. Cooper?

Mr. HOARE.—No, Mr. McLure had instructions to report direct to Mr. Cooper.

Mr. HOLGATE.—What information in the way of specifications or drawings had Mr. Kinloch to guide him in his inspection?

Mr. HOARE.—They had in their office at the bridge site exact duplicates of all erection and shop plans that were sent down from Phœnixville, and the shop plans corresponded with the approved plans by Mr. Cooper.

Mr. HOLGATE.—Were there any instructions outside of those that were issued?

Mr. HOARE.—Yes, the erection department at Phœnixville issued booklets of instructions to their foreman how to proceed in the erection of each member in the structure.

Mr. HOLGATE.—Were these instructions or blue prints approved by Mr. Cooper or yourself?

Mr. HOARE.—Not by me. Whether they were referred to Mr. Cooper or not I am not sure, but I hardly think so. He may have been consulted on the general methods of erection but I do not think each page of instructions was submitted to him.

Mr. HOLGATE.—If they had not been approved by Mr. Cooper then was Mr. Kinloch working under these detailed instructions issued by the Phœnix Bridge Company?

Mr. HOARE.—No, he did not work under the booklet instructions. They assumed the responsibility of all that themselves. Mr. Kinloch simply inspected the metal that was being placed in the bridge from time to time to take note of the fit of any joint. If any metal was defective or bent or there had been any damage it would be his duty to see that it was put in proper condition before it was finally hoisted into position in the bridge.

Mr. HOLGATE.—Had Mr. Kinloch power to have the work done in manner contrary to the methods illustrated by these blue printed instructions issued by the Phœnix Bridge Company?

Mr. HOARE.—No, sir.

Mr. HOLGATE.—Then he was bound by their instructions?

Mr. HOARE.—Well, not altogether. I said before that they would take the responsibility of their methods and procedure. Mr. Kinloch did not interfere with them unless he saw anything that was risky. If he had discovered any procedure that was risky he would have conferred with Mr. McLure and then it would have been reported from there, but no such reports have ever been made. Mr. Kinloch's duties were more mechanical, to see that there were no defects in the work or the members of the bridge, that the joints were properly bolted up. When they were riveted he had to attend to see that the bolts were properly taken out and replaced by rivets.

Mr. HOLGATE.—When you say properly taken out and replaced by rivets, does that mean that he was following out the instuctions of these blue prints, or was it left to his discretion?

Mr. HOARE.—His own proceedings were left more or less to his own discretion; that is as to where he should go on the bridge and what he should do.

Mr. HOLGATE.—I quite see that, but take the question of bolting up of a large connection, we will say one of the principal connections, would Mr. Kinloch tell the contractors how to do it, or would he simply see that they followed their own plan as shown in that blue print?

Mr. HOARE.—In these booklets there were certain instructions about bolting up joints. Until it was prepared to be riveted they had certain instructions about bolting up a joint fully or not with certain sizes of bolts. If that were not done he would call somebody's attention to it.

Mr. HOLGATE.—Were you satisfied, Mr. Hoare, with the instructions that were given on those blue prints?

Mr. HOARE.—Yes, I was perfectly satisfied.

Mr. HOLGATE.—And you would have been satisfied if Mr. Kinloch had carried out those instructions?

Mr. HOARE.—Yes. He was not under the instructions of the Phœnix Bridge Company.

Mr. HOLGATE.—I quite understand that, but it is the programme that was followed that we desire to understand.

Mr. HOARE.—I never heard any objection being made to the course laid down in these booklets. There might be some minor objections that occurred from time to time, but they did not consider it worth mentioning. I do not say that there were no objections made from time to time, but there was nothing of any importance occurred to the best of my knowledge.

Mr. HOLGATE.—If Mr. Kinloch followed out the directions and instructions given by the Phœnix Bridge Company on these blue prints to their erection foreman, you would have been satisfied?

Mr. HOARE.—As far as I know.

Mr. HOLGATE.—Had Mr. McLure the power to dismiss any employee of the Phœnix Bridge Company?

Mr. HOARE.—No, sir.

Mr. HOLGATE.—Had Mr. Kinloch that power?

Mr. HOARE.—No, sir.

Mr. HOLGATE.—Had you that power, Mr. Hoare?

Mr. HOARE.—No, sir.

Mr. HOLGATE.—Was there any power vested in Mr. Cooper?

Mr. HOARE.—No.

Mr. HOLGATE.—Had any of the officers of the Quebec Bridge Company power to stop the work of the Phœnix Bridge Company?

Mr. HOARE.—Any of the officers?

Mr. HOLGATE.—Either Mr. Cooper, yourself, McLure, or Kinloch?

Mr. HOARE.—To stop the work?

Mr. HOLGATE.—To stop the work of the Phœnix Bridge Company?

Mr. HOARE.—I do not know that there is anything in the contract which would give us any such power.

Mr. HOLGATE.—Will you say now that at the present time you cannot answer that?

Mr. HOARE.—Will you give me a minute, I will just see.

Mr. HOLGATE.—It is a question that requires very careful consideration.

Mr. HOARE.—I want to read over the contract to see whether there is any power vested in the contract. (Mr. Hoare read over the contract). There is nothing in the contract.

Mr. HOLGATE.—What is your own understanding?

Mr. HOARE.—We have got no power in the contract.

Mr. HOLGATE.—After reading the contract now, you conclude you have no power?

Mr. HOARE.—There is no power in the contract itself, no clause in the contract giving anybody connected with the company power to stop the work.

Prof. KERRY.—Had you ever considered previously, Mr. Hoare, whether you had such power?

Mr. HOARE.—No, I never considered the question at all.

Mr. HOLGATE.—Then, do I understand that this is the first time you have considered that question?

Mr. HOARE.—Yes.

Witness retired.

Commission adjourned until to-morrow morning at ten o'clock.

FOURTH DAY.

QUEBEC, THURSDAY, September 12, 1907.

The Commission resumed at ten a.m.

ULRIC BARTHE, recalled.

Mr. Barthe filed ten letters which were marked exhibit No. 23.

Prof. GALBRAITH.—Is this complete in respect to Mr. Cooper, Mr. Barthe?

Mr. BARTHE.—Yes.

Prof. GALBRAITH.—In reference to his appointment?

Mr. BARTHE.—Yes, I do not see any more. I have added one which I found yesterday—the last one in November. They cover all about the appointment of Mr. Cooper.

Witness retired.

EDWARD A. HOARE, recalled.

Mr. HOLGATE.—Mr. Hoare, will you recall the last part of your examination of yesterday? Have you any explanation you would like to make in connection with it? That referred to your power as chief engineer of the Quebec Bridge Company; you gave us the impression yesterday that you had no power to stop the work of the Phœnix Bridge Company, and you told us before that that you could not dismiss any men in the employ of the Phœnix Bridge Company.

Mr. HOARE.—I would like that statement in reference to the question of stopping the work qualified as under, and the following statement substituted: Notwithstanding that the contract does not refer to any power vested in the engineers for stopping the work at any time, I can say that if any serious question arose affecting the structure, or if there was serious damage to any part of the structure, under such circumstances I would stop the work.

Mr. HOLGATE.—You kept a diary, I suppose, of that work, Mr. Hoare?

Mr. HOARE.—Yes. The diary was kept daily by the inspectors and Mr. McLure in the field and returned to the office regularly.

Mr. HOLGATE.—Was that diary in the form of an ordinary diary, or ———?

Mr. HOARE.—It was just a daily record of everything that happened on the bridge.

Mr. HOLGATE.———or was it on a set form?

Mr. HOARE.—No set form.

Mr. HOLGATE.—The diary was in addition to the forms that were made out of daily progress?

Mr. HOARE.—Yes. I can produce that book if you wish.

Mr. HOLGATE.—Did you keep the diary?

Mr. HOARE.—No, Mr. McLure entered up every day's proceedings for me and returned the book to the office.

Mr. HOLGATE.—What record did you personally keep?

Mr. HOARE.—I kept no pocket diary apart from that except certain dates I visited the work.

Mr. HOLGATE.—Then you have a record of the times that you were present yourself at the work?

Mr. HOARE.—I do not say I noted every day I went there, but the majority of the visits I noted in my diary. There was not a day that I did not telephone and talk to them at the work. If I was not able to make personal visits I always called them on the 'phone during the day to ascertain actual facts in connection with progress.

Mr. HOLGATE.—Had you other duties to attend to, Mr. Hoare, besides the work in connection with the Quebec bridge?

Mr. HOARE.—Yes.

Mr. HOLGATE.—What were they, since 1905?

Mr. HOARE.—It was only during the last two years that I had charge of the viaduct across the Cap Rouge river.

Mr. HOLGATE.—Was there any other work?

Mr. HOARE.—Not since the construction of the bridge commenced. I had work before the construction commenced. During the time the surveys were in progress I had other work, but that is before my permanent appointment.

Mr. HOLGATE.—Since 1905 the only other work you have had was the Cap Rouge viaduct.

Mr. HOARE.—That is all.

Mr. HOLGATE.—Did that include any railway construction?

Mr. HOARE.—No, only the bridge itself.

Mr. HOLGATE.—What proportion of your time then would have been taken up by the Quebec bridge and what proportion by the other work?

Mr. HOARE.—That is for the last two years?

Mr. HOLGATE.—Yes.

Mr. HOARE.—It is rather hard to say precisely. I should think three-quarters of the time on the Quebec bridge. I attended to both, as a matter of fact, at the same time. They were so conveniently situated to each other that I could attend to both.

Mr. HOLGATE. What was the relative importance of the two works?

Mr. HOARE.—The Quebec bridge, of course, was far the most important.

Mr. HOLGATE.—Just give us an idea of your visits to Quebec bridge in the way of inspection, and the instructions that you would give on the work.

Mr. HOARE.—As a rule, I spent, whenever I visited the site, most of the day there, conferred with the inspectors as to what was going on, made a general inspection myself, asked them questions about materials. A question I asked was if everything was all right, or if anything unusual has occurred. Then I would go over the structure with them and go to the office. They would explain anything that was happening during the day in detail, and when the members were being erected I would ask them if all connections were right and precautions taken for securing everything as the work went on. They used to answer all these questions, refer to the plans of the work in progress and point out anything I asked. I used to inquire about the condition of the surface of the metal where it was in contact, where there were splices occurring to see that it was properly protected from the weather, and so forth.

Mr. HOLGATE.—In these inspections would you be accompanied by some men on the work and who would they be?

Mr. HOARE.—Just Mr. McLure and Mr. Kinloch.

Mr. HOLGATE.—What about Mr. Birks?

Mr. HOARE.—He would be present sometimes. It was not his business to attend to me when I arrived on the work. He would accidentally appear on the scene. I used to have conversations with him occasionally on the condition of the work incidentally. If there were anything specially occurring, Mr. Birks would be called into conference. There was very seldom any necessity for any special consultation of that kind.

Mr. HOLGATE.—Or with Mr. Yenser?

Mr. HOARE.—I used to talk with him every day I went down and asked him how he was getting along, and if he had come up against any difficulties, &c.—general conversation about the erection, if everything was going to his satisfaction. The answer generally was, 'We are getting along finely.' That was his general answer to my question.

Mr. HOLGATE.—Were you familiar with the scheme of erection that the Phœnix Bridge Company were operating under?

Mr. HOARE.—Yes. I did not follow every little detail in connection with the operations, but I was acquainted with their instructions, which were in a certain booklet.

Mr. HOLGATE.—Can you say that the instructions that were issued by the Phœnix Bridge Company were, to the best of your knowledge, carried out on the works?

Mr. HOARE.—Yes, I have no reason to know to the contrary.

Mr. HOLGATE.—Who prepared the monthly estimates?

Mr. HOARE.—I did.

Mr. HOLGATE.—We would like you to file all these estimates, Mr. Hoare. We would like too, Mr. Hoare, if you would go over your diary and give us a short memorandum of the occasions of your visits to the bridge since the spring of 1905. With regard to other inspections you made, Mr. Hoare, of the work before it reached the bridge, what have you to say?

Mr. HOARE.—I made personal inspections of the work in progress at Phœnixville several times a year to see that everything was going on properly, to give the inspectors instructions about anything that might turn up from time to time, and also to see that the weights of metal were being properly estimated and checked by different methods.

Mr. HOARE.—No, I cannot tell you now, but I think it must be in—there must be a letter or some reference to it in Mr. Barthe's exhibits; it must be covered by all these documents.

Prof. KERRY.—When and by whom was the advisability of these amendments suggested?

Mr. HOARE.—I could not give you the exact date when they were advised, but it was upon the advice of Mr. Cooper that these amendments were submitted to the Department of Railways and Canals for approval, which were accepted.

Prof. KERRY.—Mr. Cooper's suggestions will be in writing?

Mr. HOARE.—They should be, no doubt they are; no doubt there is a letter to that effect. I rather think there is some reference to that in those documents also, those exhibits of this morning.

Mr. HOLGATE.—Who was the representative of the Department of Railways and Canals, who would deal with the matter at that time?

Mr. HOARE.—Mr. Schreiber.

Mr. HOLGATE.—Mr. Collingwood Schreiber?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Just look over that document (exhibit No. 17) and see if that gives you any light on the matter, Mr. Hoare?

Mr. HOARE.—This refers directly to those amendments. This is the communication that leads up to that. That is the report to sanction the amendments proposed there. (Extract from Order in Council, July 23, 1903.)

Mr. HOLGATE.—What gave rise, Mr. Hoare, to the suggestions made by Mr. Cooper for the modification of the original specification?

Mr. HOARE.—He considered general improvements were necessary.

Mr. HOLGATE.—He considered it?

Mr. HOARE.—Yes, he considered that some improvements were required and necessary in some clauses of the specifications before the details were commenced by the Phœnix Bridge Co. before they commenced their detailed plans.

Mr. HOLGATE.—Did he draw up the original specifications that were made a basis for the general competition?

Mr. HOARE.—No.

Mr. HOLGATE.—Who did?

Mr. HOARE.—I did. To explain the matter a little more fully, there were a few suggestions of my own in that specification, but the majority of the changes were his own. I do not know that I could give all the specified reasons; I know with regard to one of the clauses, for wind stresses, he thought mine were unnecessarily heavy in the original specification; he gave that as one reason, that I had provided for too heavy wind pressure.

Mr. HOLGATE.—Had you and Mr. Cooper conferences prior to June 2, 1903?

Mr. HOARE.—Yes, we had several.

Mr. HOLGATE.—And were Mr. Cooper's amendments to the specification the outcome of these conferences?

Mr. HOARE.—To a certain extent, not altogether.

Mr. HOLGATE.—And at that time Mr. Cooper was the official consulting engineer for your company?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—And you submitted these questions to him? Was it necessary, in your opinion, to get his approval before they were put into contract form?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And when these specifications were amended, were they final?

Mr. HOARE.—Yes, as far as original specifications are concerned, that is all that I have any knowledge of.

Mr. HOLGATE.—And were they accepted by the Phœnix Bridge Company as complete?

Mr. HOARE.—I imagine so; I heard nothing to the contrary.

Mr. HOLGATE.—If there had been anything to the contrary you would have known it?

Mr. HOARE.—Yes, most certainly.

Mr. HOLGATE.—Were there any further specifications in connection with the work made that would amend in any way these specifications?

Mr. HOARE.—Not to my knowledge.

Mr. HOLGATE.—I would like that a definite answer if you can make it.

Mr. HOARE.—Will you repeat the question?

Question read to witness as follows:—

'Were there any further specifications in connection with the work made that would amend in any way these specifications?'

Mr. HOARE.—I am only speaking from personal knowledge; I am not aware of any. We have none on record. I do not think it is possible, but——

Mr. HOLGATE.—There must have been a finality somewhere, where was it? Were these final?

Mr. HOARE.—Yes, those are final as far as written specifications go, as far as written specifications, written or printed specifications go.

Mr. HOLGATE.—That is Exhibit No. 21.

Mr. HOARE.—But Mr. Cooper he always considered that he had the right to make any—probably they do not come under the head of specifications, but he had the right to make changes in detail from time to time as plans were submitted by the Phœnix Bridge Company; that hardly perhaps comes under that heading.

Mr. HOLGATE.—But as far as documentary evidence goes, this was the last?

Mr. HOARE.—That is the last.

Mr. HOLGATE.—I only referred to specifications.

Mr. HOARE.—That is the last.

Mr. HOLGATE.—And you feel sure in your own mind that this copy agrees with the one that was certified by the government engineer?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—Now that was your connection with the contract, Mr. Hoare?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—With regard to the carrying out of that contract what were your powers? Are your powers clearly defined in the contract?

Mr. HOARE.—In the contract with the Phœnix Bridge Company?

Mr. HOLGATE.—In the contract with the Phœnix Bridge Company?

Mr. HOARE.—Let me refer to it a minute, I have not read it for a long time. Yes, the specification governs my powers pretty well; it specifies——

Mr. HOLGATE.—You mean the contract specifies your powers?

Mr. HOARE.—Yes, the contract of the 19th of June.

Mr. HOLGATE.—Who is the engineer of the Quebec Bridge and Railway Company mentioned in this contract?

Mr. HOARE.—Myself.

Mr. HOLGATE.—And who is the consulting engineer?

Mr. HOARE.—Mr. Theodore Cooper.

Mr. HOLGATE.—And at the time that this was made who was the Deputy Minister and Chief Engineer of the Department of Railways and Canals?

Mr. HOARE.—Mr. Collingwood Schreiber.

Mr. HOLGATE.—Were there any duties that you had in connection with this contract, Mr. Hoare, outside of what are specified in the contract or does the contract fully cover them.

Mr. HOARE.—Oh, I think the contract, yes, I should say the contract fully covers them.

Mr. HOLGATE.—We would like to have you just give us a short description of the

organization that you used in the carrying out of this contract, beginning with your connection with Mr. Cooper as consulting engineer?

Mr. HOARE.—Mr. Cooper was consulting engineer, resident in New York.

Mr. HOLGATE.—Did he come here to consult you or did you go there to consult him.

Mr. HOARE.—I went there to consult him generally. You are speaking now in connection with the superstructure or the whole work?

Mr. HOLGATE.—Any time.

Mr. HOARE.—He came here during the construction of the foundations, he came here on two or three occasions. For the superstructure, I went to New York.

Mr. HOLGATE.—Do you remember the date of Mr. Cooper's last visit?

Mr. HOARE.—No, I do not at present. I can give it to you roughly, I think about three years ago, three or four years ago.

Mr. HOLGATE.—The last visit?

Mr. HOARE.—Yes, he was here on three occasions during the sinking of the caissons for the bridge foundation. I do not think he has been here since, but he received weekly reports.

Mr. HOLGATE.—You had a system of——

Mr. HOARE.—We had a system of weekly reports.

Mr. HOLGATE.—Who made these reports?

Mr. HOARE.—Mr. McLure.

Mr. HOLGATE.—Who is Mr. McLure?

Mr. HOARE.—Inspecting engineer on the erection.

Mr. HOLGATE.—By whom was he appointed?

Mr. HOARE.—Jointly, by mutual agreement between Mr. Cooper and myself.

Mr. HOLGATE.—To whom does he report?

Mr. HOARE.—Both of us, and Mr. Cooper's communication with the bridge was maintained through Mr. McLure's weekly reports.

Prof. KERRY.—What was your knowledge of Mr. McLure that made you make that selection, Mr. Hoare?

Mr. HOARE.—Previous to his engagement I could not find anybody suitable for that position and I left it entirely to Mr. Cooper. I left it entirely to him, and he nominated Mr. McLure to the position. I had previous authority from the Bridge Company to arrange personally or mutually with Mr. Cooper for any inspectors wanted for that work.

Prof. KERRY.—Then in the selection of Mr. McLure you felt that you had fully provided for all necessary inspection?

Mr. HOARE.—No, there are other inspectors besides. On the erection Mr. Kinloch was appointed.

Prof. KERRY.—But the appointment of Mr. McLure and Mr. Kinloch was your carrying out of the instructions or the commission of the board of directors to organize fully a competent inspection?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Could you have dismissed Mr. McLure, Mr. Hoare?

Mr. HOARE.—I could have, but I would not have done it without coming to an agreement with Mr. Cooper.

Mr. HOLGATE.—Could Mr. Cooper have dismissed him without coming to an agreement with you?

Mr. HOARE.—No, I do not think he could, because he would not have done so. I do not think he would have done so, but it is doubtful whether he could.

Mr. HOLGATE.—You mentioned, I think, another name?

Mr. HOARE.—Mr. Kinloch, on the erection.

Mr. HOLGATE.—Now, would you tell us what Mr. McLure's duties were. You have already put it in the form of a letter dated September 7, 1907 (document produced, filed and marked as Exhibit No. 22) see if that correctly describes his duties?

Mr. HOARE.—Yes. In addition to what I have stated here, if there was anything of importance occurred he had always orders to telegraph immediately to Mr. Cooper for advice on any question of importance or emergency, in addition to what I have stated there, but that generally covers, I think, his duty.

Mr. HOLGATE.—Then does this letter also cover a description of Mr. Kinloch's duties?

Mr. HOARE.—Yes, I should have said to him or to me, but that substantially covers his duties.

Mr. HOLGATE.—'To Mr. McLure or to me.'

Mr. HOARE.—Yes, or to me.

Mr. HOLGATE.—Then I understand that you had some further inspectors at the works where the superstructure was fabricated?

Mr. HOARE.—Yes.

Mr. HOLGATE.—You might give us those names.

Mr. HOARE.—At Phœnixville, Mr. Edwards and Mr. Meeser.

Mr. HOLGATE.—And their duties were what?

Mr. HOARE.—And Mr. Keenan. He was mill inspector at Harrisburg; and there were others employed from time to time as mill inspectors as required, and their services dispensed with when the work at that particular mill was completed. The only two of those inspectors employed at the present time are Mr. Edwards and Mr. Meeser. Mr. Edwards is chief inspector, and Mr. Meeser is his assistant. Their duties are, to inspect the shop work and mill work at Phœnixville. Beyond that Mr. Edwards duties are to keep strict account of the metal delivered from outside mills to be fabricated at the Phœnixville shops, and all metal shipped from there to Quebec; to make returns to me of the quantities of metal rolled, fabricated and shipped, at regular intervals. He had also to furnish me with detailed reports of all metal inspected at the mills as well as at the shops, also chemical tests of metal in the different melts at the scale works. Besides the ordinary specimen tests required from time to time they were instructed to make full size eye-bar tests to destruction. About two per cent of the total number of eye-bars in the structure were tested in this manner.

Mr. HOLGATE.—Are there full reports of all these tests in existence?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Can they be produced here?

Mr. HOARE.—I can produce them.

Mr. HOLGATE.—Then we would require these two inspectors?

Mr. HOARE.—They will be here on Thursday, I sent for them.

Mr. HOLGATE.—Were these tests demanded by the contract?

Mr. HOARE.—Yes—no, demanded by the specifications more strictly speaking.

Mr. HOLGATE.—Well, of course by the specifications.

Mr. HOARE.—By the specifications, yes.

Mr. HOLGATE.—And were all these tests made in accordance with the demands of the specifications?

Mr. HOARE.—I think they were exceeded.

Mr. HOLGATE.—And were there tests made beyond what the specifications called for?

Mr. HOARE.—I think so. If any departure was made it was in excess of the requirement of the specification.

Mr. HOLGATE.—But we will get full details of that from the inspectors?

Mr. HOARE.—You will get full details of that from the inspectors.

Mr. HOLGATE.—Now, with regard to Mr. McLure, you state that Mr. McLure's duties were to thoroughly inspect all material which arrived at the storage yard from Phœnixville, before it was placed in the bridge, to check, with Mr. Birks, the dimensions of all members and to see that they were properly assembled according to erection plans before the erection foreman was allowed to place them in the bridge. Were those instructions, to your knowledge, carried out?

Mr. HOARE.—Yes, I believe they were thoroughly carried out in every particular.

Mr. HOLGATE.—Were these instructions given to Mr. McLure in writing?

Mr. HOARE.—I do not know that they were given in writing, word for word, to correspond with my letter, but he received very clear instructions from Mr. Cooper before he came here what his duties were.

Mr. HOLGATE.—Did you issue any instructions to Mr. McLure in writing?

Mr. HOARE.—No, sir, I considered Mr. Cooper's instructions quite sufficient.

Mr. HOLGATE.—Did you see the instructions, Mr. Hoare, that Mr. McLure received from Mr. Cooper?

Mr. HOARE.—Yes, sir, when he first came here I saw them.

Mr. HOLGATE.—There was a letter of instructions that Mr. McLure got from Mr. Cooper?

Mr. HOARE.—Yes, sir, and he showed it to me immediately on arrival.

Mr. HOLGATE.—In your opinion, Mr. Hoare, was it an important step to inspect all metal which arrived at the storage yard?

Mr. HOARE.—Yes, very.

Mr. HOLGATE.—Very important?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And you are quite sure that the inspection was carried out?

Mr. HOARE.—I am positive that those two gentlemen thoroughly carried out their instructions and duties in that respect.

Mr. HOLGATE.—Would this apply both to Mr. McLure and Mr. Kinloch?

Mr. HOARE.—Both, to both of them.

Mr. HOLGATE.—Then Mr. McLure, according to your understanding, Mr. Hoare had to, as part if his duty, check, with Mr. Birks, the dimensions of all members?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Where would that be done?

Mr. HOARE.—Generally speaking, before the metal is taken off the cars on the bridge. I said before the metal was lifted off the cars on the bridge to put it into position.

Mr. HOLGATE.—And that differs from his other inspection, which was, you understand, made in the yard?

Mr. HOARE.—Oh, they used to inspect at both places as necessity required, inspected the metal at both places, one or other of them would inspect the metal at both places.

Mr. HOLGATE.—But it was your understanding that the rule was all that should be inspected on arrival at the storage yard?

Mr. HOARE.—They possibly would not inspect every piece of metal, but every important piece of metal would be looked over on arrival to see if it had sustained any damage during transportation. The final inspection was made on the cars prior to the metal being hoisted into position, and they also checked over—not only inspected the metal to look out for defects, but to check with the erection plans to see that the proper members were assembled correctly, to see that the members were corretly assembled.

Mr. HOLGATE.—In all these matters, Mr. Hoare, are you speaking from your positive personal knowledge of what was done?

Mr. HOARE.—Personal knowledge.

Mr. HOLGATE.—Not simply from what instructions you gave, or someone else gave, of what was done?

Mr. HOARE.—Personal knowledge, what I know myself.

Prof. KERRY.—Do I understand that the dimensions of the members were actually checked by Mr. Birks and Mr. McLure together?

Mr. HOARE.—On the cars, yes.

Prof. KERRY.—On the cars?

Mr. HOARE.—Finally, before they were lifted into position.

Prof. KERRY.—That was the regulation practice?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Who would order the parts forward from the yard to the bridge?

Mr. HOARE.—The foreman of erection.

Mr. HOLGATE.—Of the Phœnix Bridge Company?

Mr. HOARE.—The Phœnix Bridge Company's foreman of erection would call for members in the yard as he required them.

Mr. HOLGATE.—But according to your system that would already have been inspected by the Quebec Bridge Company's inspector.

Mr. HOARE.—Yes, and then inspected again at the bridge before the members were lifted to position.

Mr. HOLGATE.—Mr. Kinloch then was appointed by yourself?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—And responsible to you?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—To you only?

Mr. HOARE.—To me only.

Mr. HOLGATE.—What was his relation then with Mr. McLure?

Mr. HOARE.—He assisted, he worked with Mr. McLure, inspecting mechanical parts of the bridge, riveted and so forth.

Mr. HOLGATE.—Mr. McLure's inspection then was more general than Mr. Kinloch's?

Mr. HOARE.—A little more general and his work was more technical and clerical. He had to look after technical questions that arose from time to time.

Mr. HOLGATE.—Was Mr. Kinloch's work principally on details?

Mr. HOARE.—Yes, detailed work; that is inspecting the metal generally before it went into the work, joints, riveting, bolting and so forth.

Mr. HOLGATE.—Under whose instructions would he work?

Mr. HOARE.—I gave him instructions from time to time and he always conferred with Mr. McLure, worked with him in fact and conferred with him from time to time, and if he discovered anything unnatural, anything out of the common, he would always mention it to Mr. McLure, and he would report the matter to myself and Mr. Cooper, and make his record of same. Mr. McLure kept all the records of the work, that is the daily diary of what occurred during a season's work.

Mr. HOLGATE.—Then, did Mr. Kinloch report to Mr. McLure?

Mr. HOARE.—Yes, they did not work independently. Anything he discovered in the work that Mr. McLure did not see, the first thing he would do would be to report to Mr. McLure, so it would be recorded and then it would come to me through Mr. McLure and to Mr. Cooper if necessary, to the Phœnix Bridge Company.

Mr. HOLGATE.—Through you to Mr. Cooper or through Mr. McLure to Mr. Cooper?

Mr. HOARE.—No, Mr. McLure had instructions to report direct to Mr. Cooper.

Mr. HOLGATE.—What information in the way of specifications or drawings had Mr. Kinloch to guide him in his inspection?

Mr. HOARE.—They had in their office at the bridge site exact duplicates of all erection and shop plans that were sent down from Phœnixville, and the shop plans corresponded with the approved plans by Mr. Cooper.

Mr. HOLGATE.—Were there any instructions outside of those that were issued?

Mr. HOARE.—Yes, the erection department at Phœnixville issued booklets of instructions to their foreman how to proceed in the erection of each member in the structure.

Mr. HOLGATE.—Were these instructions or blue prints approved by Mr. Cooper or yourself?

Mr. HOARE.—Not by me. Whether they were referred to Mr. Cooper or not I am not sure, but I hardly think so. He may have been consulted on the general methods of erection but I do not think each page of instructions was submitted to him.

Mr. HOLGATE.—If they had not been approved by Mr. Cooper then was Mr. Kinloch working under these detailed instructions issued by the Phœnix Bridge Company?

Mr. HOARE.—No, he did not work under the booklet instructions. They assumed the responsibility of all that themselves. Mr. Kinloch simply inspected the metal that was being placed in the bridge from time to time to take note of the fit of any joint. If any metal was defective or bent or there had been any damage it would be his duty to see that it was put in proper condition before it was finally hoisted into position in the bridge.

Mr. HOLGATE.—Had Mr. Kinloch power to have the work done in manner contrary to the methods illustrated by these blue printed instructions issued by the Phœnix Bridge Company?

Mr. HOARE.—No, sir.

Mr. HOLGATE.—Then he was bound by their instructions?

Mr. HOARE.—Well, not altogether. I said before that they would take the responsibility of their methods and procedure. Mr. Kinloch did not interfere with them unless he saw anything that was risky. If he had discovered any procedure that was risky he would have conferred with Mr. McLure and then it would have been reported from there, but no such reports have ever been made. Mr. Kinloch's duties were more mechanical, to see that there were no defects in the work or the members of the bridge, that the joints were properly bolted up. When they were riveted he had to attend to see that the bolts were properly taken out and replaced by rivets.

Mr. HOLGATE.—When you say properly taken out and replaced by rivets, does that mean that he was following out the instuctions of these blue prints, or was it left to his discretion?

Mr. HOARE.—His own proceedings were left more or less to his own discretion; that is as to where he should go on the bridge and what he should do.

Mr. HOLGATE.—I quite see that, but take the question of bolting up of a large connection, we will say one of the principal connections, would Mr. Kinloch tell the contractors how to do it, or would he simply see that they followed their own plan as shown in that blue print?

Mr. HOARE.—In these booklets there were certain instructions about bolting up joints. Until it was prepared to be riveted they had certain instructions about bolting up a joint fully or not with certain sizes of bolts. If that were not done he would call somebody's attention to it.

Mr. HOLGATE.—Were you satisfied, Mr. Hoare, with the instructions that were given on those blue prints?

Mr. HOARE.—Yes, I was perfectly satisfied.

Mr. HOLGATE.—And you would have been satisfied if Mr. Kinloch had carried out those instructions?

Mr. HOARE.—Yes. He was not under the instructions of the Phœnix Bridge Company.

Mr. HOLGATE.—I quite understand that, but it is the programme that was followed that we desire to understand.

Mr. HOARE.—I never heard any objection being made to the course laid down in these booklets. There might be some minor objections that occurred from time to time, but they did not consider it worth mentioning. I do not say that there were no objections made from time to time, but there was nothing of any importance occurred to the best of my knowledge.

Mr. HOLGATE.—If Mr. Kinloch followed out the directions and instructions given by the Phœnix Bridge Company on these blue prints to their erection foreman, you would have been satisfied?

Mr. HOARE.—As far as I know.

Mr. HOLGATE.—Had Mr. McLure the power to dismiss any employee of the Phœnix Bridge Company?

Mr. HOARE.—No, sir.

Mr. HOLGATE.—Had Mr. Kinloch that power?

Mr. HOARE.—No, sir.

Mr. HOLGATE.—Had you that power, Mr. Hoare?

Mr. HOARE.—No, sir.

Mr. HOLGATE.—Was there any power vested in Mr. Cooper?

Mr. HOARE.—No.

Mr. HOLGATE.—Had any of the officers of the Quebec Bridge Company power to stop the work of the Phœnix Bridge Company?

Mr. HOARE.—Any of the officers?

Mr. HOLGATE.—Either Mr. Cooper, yourself, McLure, or Kinloch?

Mr. HOARE.—To stop the work?

Mr. HOLGATE.—To stop the work of the Phœnix Bridge Company?

Mr. HOARE.—I do not know that there is anything in the contract which would give us any such power.

Mr. HOLGATE.—Will you say now that at the present time you cannot answer that?

Mr. HOARE.—Will you give me a minute, I will just see.

Mr. HOLGATE.—It is a question that requires very careful consideration.

Mr. HOARE.—I want to read over the contract to see whether there is any power vested in the contract. (Mr. Hoare read over the contract). There is nothing in the contract.

Mr. HOLGATE.—What is your own understanding?

Mr. HOARE.—We have got no power in the contract.

Mr. HOLGATE.—After reading the contract now, you conclude you have no power?

Mr. HOARE.—There is no power in the contract itself, no clause in the contract giving anybody connected with the company power to stop the work.

Prof. KERRY.—Had you ever considered previously, Mr. Hoare, whether you had such power?

Mr. HOARE.—No, I never considered the question at all.

Mr. HOLGATE.—Then, do I understand that this is the first time you have considered that question?

Mr. HOARE.—Yes.

Witness retired.

Commission adjourned until to-morrow morning at ten o'clock.

FOURTH DAY.

QUEBEC, THURSDAY, September 12, 1907.

The Commission resumed at ten a.m.

ULRIC BARTHE, recalled.

Mr. Barthe filed ten letters which were marked exhibit No. 23.

Prof. GALBRAITH.—Is this complete in respect to Mr. Cooper, Mr. Barthe?

Mr. BARTHE.—Yes.

Prof. GALBRAITH.—In reference to his appointment?

Mr. BARTHE.—Yes, I do not see any more. I have added one which I found yesterday—the last one in November. They cover all about the appointment of Mr. Cooper.

Witness retired.

EDWARD A. HOARE, recalled.

Mr. HOLGATE.—Mr. Hoare, will you recall the last part of your examination of yesterday? Have you any explanation you would like to make in connection with it? That referred to your power as chief engineer of the Quebec Bridge Company; you gave us the impression yesterday that you had no power to stop the work of the Phœnix Bridge Company, and you told us before that that you could not dismiss any men in the employ of the Phœnix Bridge Company.

Mr. HOARE.—I would like that statement in reference to the question of stopping the work qualified as under, and the following statement substituted: Notwithstanding that the contract does not refer to any power vested in the engineers for stopping the work at any time, I can say that if any serious question arose affecting the structure, or if there was serious damage to any part of the structure, under such circumstances I would stop the work.

Mr. HOLGATE.—You kept a diary, I suppose, of that work, Mr. Hoare?

Mr. HOARE.—Yes. The diary was kept daily by the inspectors and Mr. McLure in the field and returned to the office regularly.

Mr. HOLGATE.—Was that diary in the form of an ordinary diary, or ———?

Mr. HOARE.—It was just a daily record of everything that happened on the bridge.

Mr. HOLGATE.———or was it on a set form?

Mr. HOARE.—No set form.

Mr. HOLGATE.—The diary was in addition to the forms that were made out of daily progress?

Mr. HOARE.—Yes. I can produce that book if you wish.

Mr. HOLGATE.—Did you keep the diary?

Mr. HOARE.—No, Mr. McLure entered up every day's proceedings for me and returned the book to the office.

Mr. HOLGATE.—What record did you personally keep?

Mr. HOARE.—I kept no pocket diary apart from that except certain dates I visited the work.

Mr. HOLGATE.—Then you have a record of the times that you were present yourself at the work?

Mr. HOARE.—I do not say I noted every day I went there, but the majority of the visits I noted in my diary. There was not a day that I did not telephone and talk to them at the work. If I was not able to make personal visits I always called them on the 'phone during the day to ascertain actual facts in connection with progress.

Mr. HOLGATE.—Had you other duties to attend to, Mr. Hoare, besides the work in connection with the Quebec bridge?

Mr. HOARE.—Yes.

Mr. HOLGATE.—What were they, since 1905?

Mr. HOARE.—It was only during the last two years that I had charge of the viaduct across the Cap Rouge river.

Mr. HOLGATE.—Was there any other work?

Mr. HOARE.—Not since the construction of the bridge commenced. I had work before the construction commenced. During the time the surveys were in progress I had other work, but that is before my permanent appointment.

Mr. HOLGATE.—Since 1905 the only other work you have had was the Cap Rouge viaduct.

Mr. HOARE.—That is all.

Mr. HOLGATE.—Did that include any railway construction?

Mr. HOARE.—No, only the bridge itself.

Mr. HOLGATE.—What proportion of your time then would have been taken up by the Quebec bridge and what proportion by the other work?

Mr. HOARE.—That is for the last two years?

Mr. HOLGATE.—Yes.

Mr. HOARE.—It is rather hard to say precisely. I should think three-quarters of the time on the Quebec bridge. I attended to both, as a matter of fact, at the same time. They were so conveniently situated to each other that I could attend to both.

Mr. HOLGATE. What was the relative importance of the two works?

Mr. HOARE.—The Quebec bridge, of course, was far the most important.

Mr. HOLGATE.—Just give us an idea of your visits to Quebec bridge in the way of inspection, and the instructions that you would give on the work.

Mr. HOARE.—As a rule, I spent, whenever I visited the site, most of the day there, conferred with the inspectors as to what was going on, made a general inspection myself, asked them questions about materials. A question I asked was if everything was all right, or if anything unusual has occurred. Then I would go over the structure with them and go to the office. They would explain anything that was happening during the day in detail, and when the members were being erected I would ask them if all connections were right and precautions taken for securing everything as the work went on. They used to answer all these questions, refer to the plans of the work in progress and point out anything I asked. I used to inquire about the condition of the surface of the metal where it was in contact, where there were splices occurring to see that it was properly protected from the weather, and so forth.

Mr. HOLGATE.—In these inspections would you be accompanied by some men on the work and who would they be?

Mr. HOARE.—Just Mr. McLure and Mr. Kinloch.

Mr. HOLGATE.—What about Mr. Birks?

Mr. HOARE.—He would be present sometimes. It was not his business to attend to me when I arrived on the work. He would accidentally appear on the scene. I used to have conversations with him occasionally on the condition of the work incidentally. If there were anything specially occurring, Mr. Birks would be called into conference. There was very seldom any necessity for any special consultation of that kind.

Mr. HOLGATE.—Or with Mr. Yenser?

Mr. HOARE.—I used to talk with him every day I went down and asked him how he was getting along, and if he had come up against any difficulties, &c.—general conversation about the erection, if everything was going to his satisfaction. The answer generally was, 'We are getting along finely.' That was his general answer to my question.

Mr. HOLGATE.—Were you familiar with the scheme of erection that the Phœnix Bridge Company were operating under?

Mr. HOARE.—Yes. I did not follow every little detail in connection with the operations, but I was acquainted with their instructions, which were in a certain booklet.

Mr. HOLGATE.—Can you say that the instructions that were issued by the Phœnix Bridge Company were, to the best of your knowledge, carried out on the works?

Mr. HOARE.—Yes, I have no reason to know to the contrary.

Mr. HOLGATE.—Who prepared the monthly estimates?

Mr. HOARE.—I did.

Mr. HOLGATE.—We would like you to file all these estimates, Mr. Hoare. We would like too, Mr. Hoare, if you would go over your diary and give us a short memorandum of the occasions of your visits to the bridge since the spring of 1905. With regard to other inspections you made, Mr. Hoare, of the work before it reached the bridge, what have you to say?

Mr. HOARE.—I made personal inspections of the work in progress at Phœnixville several times a year to see that everything was going on properly, to give the inspectors instructions about anything that might turn up from time to time, and also to see that the weights of metal were being properly estimated and checked by different methods.

Mr. HOLGATE.—This took considerable time, I suppose?

Mr. HOARE.—Yes, all this work went on for several years. This process extended over several years.

Mr. HOLGATE.—On these occasions would you meet Mr. Edwards and Mr.——?

Mr. HOARE.—I used to meet all the inspectors, Edwards and Meeser, except the metal inspectors, who were at a distance, at Bethlehem, Harrisburg and Pittsburg. The inspectors also had orders to confer with Mr. Cooper immediately if any doubtful question arose in the tests.

Mr. HOLGATE.—In regard to the question of the inspection of material on its arrival at the bridge site, have you anything further to say?

Mr. HOARE.—Yes, I want it to be clearly understood that the final and most important inspection on the works took place on the bridge itself. An inspection at the storage yard was also made as occasion required more especially to ascertain if any damage to the metal had occurred during transportation. There were minor repairs occasionally required, and that was generally done at the storage yard. That was the object of the storage yard inspection. My evidence probably was not quite clear in that respect.

Mr. HOLGATE.—Well, Mr. Hoare, can you show us that there was a written scheme of inspection, or of organization, or directions, which would demand that course that you now say was the intention?

Mr. HOARE.—No, I do not think there are any written instructions, but that course was thoroughly understood by the inspectors on the work. There is no question about that.

Mr. HOLGATE.—But they were never instructed?

Mr. HOARE.—I do not think they were instructed precisely in writing to that effect, but they thoroughly understood their duties in that respect.

Mr. HOLGATE.—So far as the respective authority of Mr. Cooper and of yourself on the one side, and of the Phœnix Bridge Company's engineers on the other, were there any instructions or directions to be found outside of the written contract and correspondence?

Mr. HOARE.—I think only in one instance; there was a letter of instructions given by Mr. Cooper to Mr. McLure concerning the information that he wanted sent to him direct.

Mr. STUART.—By Mr. Cooper?

Mr. HOARE.—Yes, that is the only one I remember at the time.

Mr. HOLGATE.—I will repeat the question. (Question repeated.)

Mr. HOARE.—Not to my knowledge.

Mr. HOLGATE.—Were the original specifications sufficient as a basis for comparing tenders?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Then, modifications were found necessary in these specifications?

Mr. HOARE.—Yes.

Mr. HOLGATE.—For what particular reasons? Were the modifications in order that they might comply with conditions that had not been previously considered?

Mr. HOARE.—Yes, to comply more closely with actual conditions of live loads and wind loads and some change in formula to provide for excessive dead loads. These were the principal reasons requiring the modifications as far as I can remember.

Mr. HOLGATE.—Would these modifications increase or decrease the cost of the work?

Mr. HOARE.—I do not think it would make much difference. I think the provision for wind was reduced and the provision for live loads increased. I do not believe the result would be much difference in the weight of metal; if anything, probably it would be increased.

Mr. HOLGATE.—Who, on the works, took care of the wind records?

Mr. HOARE.—There was an automatic register, an ananometer.

Mr. HOLGATE.—In charge of ?

Mr. HOARE.—The Phœnix Bridge Company.

Mr. STUART.—Mr. Cudworth took charge of that.

Mr. HOLGATE.—We want these wind records for this season.

Mr. DEANS.—We have a full record of them taken automatically by an electrical arrangement. We will furnish them.

Mr. HOARE.—My daily erection records show the daily wind records as well.

Mr. HOLGATE.—We have asked Mr. McLure for copies of all these daily reports. Are those the reports that you referred to?

Mr. HOARE.—They are the same as I have—identically the same.

Mr. HOLGATE.—There are quite a number of things we want you to take down. Will you make a memorandum of them ?

Mr. HOARE.—Yes.

Mr. HOLGATE.—There are the monthly estimates.

Mr. HOARE.—Certified copies ?

Mr. HOLGATE.—Yes.

Mr. HOLGATE.—A memo. of your various visits to the bridge.

Mr. HOARE.—Since the season of 1905 ?

Mr. HOLGATE.—Since the spring of 1905.

Mr. HOARE.—Is that all?

Mr. HOLGATE.—We would like you to let us have the copies of the resolutions of your board in connection with your appointment and if your duties were defined in writing we would like to have a copy of that document, or you might let us know now if they were defined in writing ?

Mr. HOARE.—No, they were not.

Mr. HOLGATE.—The position that you occupied, Mr. Hoare, we understand, was that of chief engineer ?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Of course, we have our own ideas with regard to the powers and duties of a chief engineer on works and our interpretation of that title generally would be that the chief engineer was the absolute authority on that work, that he would have power to reject material if he did not approve of it, that he would have power to dismiss any employee of the contractors that he considered was incompetent, or was doing work improperly, or was misbehaving himeslf on the work, and that he would have power over the whole work to the extent of stopping any portion of the work during its progress, or the whole of the work, if, in his opinion, it was not being carried on entirely to his satisfaction, having in mind the letter and the spirit of the contract, the specification and the plans. Now, with that definition, would your position correspond with its duties ?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—Then who was primarily responsible for the specifications?

Mr. HOARE.—The original?

Mr. HOLGATE.—The specifications under which the work was carried out.

Mr. HOARE.—I was primarily responsible for the original, and, for the modifications, Mr. Cooper—responsible for the changes.

Prof. KERRY.—Was any reference to you necessary on the part of Mr. Cooper, or was Mr. Cooper the absolute authority?

Mr. HOARE.—He had absolute authority to deal with the question.

Prof. KERRY.—In that respect, then, Mr. Cooper was the chief engineer of the bridge?

Mr. HOARE.—No, sir, he was consulting engineer and his appointment as consulting engineer gave him power to make these changes.

Prof. KERRY.—That is to say, his appointment delegated part of the authority of the chief engineer to him.

Mr. HOARE.—That is right.

Mr. HOLGATE.—Who was responsible then, primarily, for the plans?

Mr. HOARE.—The working plans, the structural plans the bridge is built on?

Mr. HOLGATE.—The plans on which the bridge was built.

Mr. HOARE.—In the first place they were made by the Phœnix Bridge Company?

Mr. HOLGATE.—Designed——

Mr. HOARE.—Designed by the Phœnix Bridge Company, submitted to Mr. Cooper as consulting engineer for his approvel, finally sent to the Department of Railways and Canals in Ottawa for approval; after the stated approvals had been obtained the plans were returned to the Phœnix Bridge Company duly certified for construction purposes. It was my duty to see that these plans were approved by the Dominion Government and returned to the Phœnix Bridge Company.

Mr. HOLGATE.—Did you yourself approve the plans?

Mr. HOARE.—No, sir.

Prof. KERRY.—To make it clear, the power to reject those plans was vested first in Mr. Cooper and secondly in the chief engineer of the Department of Railways and Canals.

Mr. HOARE.—Yes, sir, precisely.

Prof. KERRY.—And you are personally aware that all plans were approved by the chief engineer of the Department of Railways and Canals.

Mr. HOARE.—Yes.

Mr. HOLGATE.—Were the original specifications discussed between you and Mr. Cooper before the tenders were called for?

Mr. HOARE.—No, sir.

Prof. KERRY.—Were those specifications based on any of the well known standard specifications?

Mr. HOARE.—Yes, sir.

Prof. KERRY.—On which of them?

Mr. HOARE.—I cannot at the moment state definitely now, but they were based on other standard specifications.

Prof. KERRY.—So they did not follow, for instance, the standard specifications in the Department of Railways and Canals, or any one specification probably.

Mr. HOARE.—In some respects, in some respects.

Mr. HOLGATE.—Who prepared these specifications?

Mr. HOARE.—Myself.

Mr. HOLGATE.—Then was the same course taken with regard to the general plan at that time, was it discussed between yourself——

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—Was it discussed between yourself and Mr. Cooper before tenders were called for?

Mr. HOARE.—No.

Mr. HOLGATE.—And that preliminary general plan was prepared by yourself?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Then the working plans, Mr. Hoare, were the plans of the Phœnix Bridge Company?

Mr. HOARE.—Yes, sir, made and designed by them.

Mr. HOLGATE.—Approved by Mr. Cooper?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—And by the Department of Railways and Canals?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And were they approved by you?

Mr. HOARE.—No.

Mr. HOLGATE.—Then as to the fabrication of the material in the works of the contractor, who was responsible for that in so far as the Quebec Bridge Company is concerned?

Mr. HOARE.—Myself.

Prof. KERRY.—Could you define accurately, Mr. Hoare, in the case of that inspection of material in fabrication the position of Mr. Cooper? We understand from a letter filed with the commission here from Mr. Cooper (being part of exhibit No. 23), dated November 26, 1900, that his services were retained as consulting engineer and for supervising all required inspection. And we also understand from your evidence that any important point that came up with regard to shop inspection was to be directly reported to Mr. Cooper?

Mr. HOARE.—Yes.

Prof. KERRY.—Then Mr. Cooper's decision on these matters was final?

Mr. HOARE.—Always final, that was, he was within reasonable distance of the Phœnix works, and the inspectors all had instructions when anything occurred of any importance that they were to confer with Mr. Cooper immediately.

Prof. KERRY.—The inspectors then would be appointed by yourself?

Mr. HOARE.—Yes, they were all appointed by myself. Mr. Cooper and I had mutual arrangement about all these matters. Some I appointed and some he appointed, because I could not find suitable men, and when I could not find a suitable man for a certain purpose I asked him to find one. Arrangements of this kind were mutually agreed to.

Prof. KERRY.—And the Quebec Bridge Company relied on the services of those inspectors, under the guidance of Mr. Cooper, for satisfactory material?

Mr. HOARE.—Yes, and myself as well, I share in the responsibility of that inspection.

Prof. KERRY.—That is to say the inspectors reported both to Mr. Cooper and yourself?

Mr. HOARE.—The inspectors reported to both.

Prof. KERRY.—It was a divided responsibility?

Mr. HOARE.—It was a divided responsibility.

Prof. KERRY.—And would there be any differences of opinion arise in a case of that sort?

Mr. HOARE.—No, nothing occurred of the kind.

Prof. KERRY.—That is to say that when Mr. Cooper finally expressed an opinion it was accepted.

Mr. HOARE.—It was final.

Mr. HOLGATE.—You have the reports of the inspectors?

Mr. HOARE.—Yes, all the inspectors' reports were sent to me regularly?

Mr. HOLGATE.—I understand the inspectors are coming here?

Mr. HOARE.—They are to be here to-morrow.

Mr. HOLGATE.—Are all the documents showing the inspection here in Quebec, so that they will be able to produce them?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—Are they in your possession now?

Mr. HOARE.—I have one set and the inspectors are bringing their own themselves. They are instructed to bring all the documents bearing on the inspection from the start.

Mr. HOLGATE.—In order that there may be no mistake about those reports we would like you to put them all together, your own reports?

Mr. HOARE.—Yes, I have mine all ready.

Mr. HOLGATE.—Now then, following out this question of responsibility, we have come to the fabrication, now we come to the erection. Who was primarily responsible for the erection?

Mr. HOARE.—The Phœnix Bridge Company.

Mr. HOLGATE.—Then where was your responsibility with regard to the erection?

Mr. HOARE.—My duty was to see that my inspectors attended to their duties, and that all precautions were taken in the conduct of the work.

Prof. KERRY.—To make that clear, Mr. Hoare, the erection plans were prepared by the Phœnix Bridge Company.

Mr. HOARE.—Yes.

Prof. KERRY.—They were under no necessity to submit those plans to anyone?

Mr. HOARE.—No, as a matter of fact they consulted Mr. Cooper.

Prof. KERRY.—They consulted as a matter of fact with Mr. Cooper?

Mr. HOARE.—As a matter of fact, as a matter of precaution, just to get his ideas on the methods adopted, but they had no obligation on their part to submit those plans.

Prof. KERRY.—What member or members of the staff of the Quebec Bridge Company was thoroughly conversant personally with those erection plans?

Mr. HOARE.—The inspectors on the work. It was their duty to be thoroughly conversant with those plans.

Prof. GALBRAITH.—Did I understand you to say that the erection plans had to be submitted to Mr. Cooper?

Mr. HOARE.—There was nothing obligatory.

Prof. GALBRAITH.—Or that they were?

Mr. HOARE.—But the Phœnix Bridge engineers made a practice of conferring with Mr. Cooper on certain methods adopted for erection.

Prof. GALRBAITH.—You know that through Mr. Cooper?

Mr. HOARE.—I simply know it by hearsay when I was at Phœnixville.

Prof. GALBRAITH.—But they were not bound in any way to do so?

Mr. HOARE.—No, not to my knowledge, there is no contract obligation.

Prof. KERRY.—What precautions were taken, Mr. Hoare, to ensure that the inspectors had a full file of these erection plans and to make sure that they were fully conversant with them?

Mr. HOARE.—I made personal application to the Phœnix Bridge Company to supply the Quebec Bridge Company with erection plans, that is to supply the office on the works with all the erection plans, that whenever they sent plans to their men they should send us duplicates of the same and whenever those plans did not arrive punctually, when they were in arrears, Mr. McLure used to call my attention to it, and we would call the attention of the Phœnix Bridge Company's engineer to that fact and request that those plans be immediately supplied.

Prof. KERRY.—And in so far as the detail of these erection plans is concerned, the knowledge of that detail, you depended on your inspectors?

Mr. HOARE.—The details, you mean the plans upon which——

Prof. KERRY.—Upon which they were erected.

Mr. HOARE.—The different travellers and hoisting machines were constructed upon?

Prof. KERRY.—The whole mass of plans involving a complete understanding of the way in which the bridge was to be erected.

Mr. HOARE.—We did not investigate the details of any of the erection plant, that was left entirely to the Phœnix Bridge Company, and they, as I said before, conferred with Mr. Cooper, consulted him on the methods adopted, the general principles, which I believe he thought was satisfactory. That is, to the best of my knowledge he thought they were quite satisfactory.

Prof. KERRY.—Then would it be correct to say on the part of the Quebec Bridge Company that it took the ground that it was not concerned in the methods of erection adopted by the Phœnix Bridge Company, that the Bridge Company under contract took the full responsibility for these erection methods?

Mr. HOARE.—Yes, that was the——

Prof. KERRY.—That is a correct statement of the position?

Mr. HOARE.—That is a correct statement of the position, I think.

Prof. KERRY.—Do you know personally whether Mr. Cooper interfered with the erection plans of the Phœnix Bridge Company in any way?

Mr. HOARE.—Not to my knowledge.

Prof. KERRY.—Or did he approve them?

Mr. HOARE.—No, sir, not officially.

Prof. KERRY.—Or unofficially, simply to your own knowledge?

Mr. HOARE.—I do not know, I cannot say that he even approved of them unofficially. All I can state positively is that the Phœnix Bridge Company's engineer conferred with him from time to time on their methods of erection, which I always understood he approved, but not in any official manner; he took no responsibility in the matter nor was he called upon to. In fact the entire responsibility rested with the Phœnix Bridge Company under their contract with the Quebec Bridge Company in that respect.

Prof. KERRY.—Now, I do not see under that situation, Mr. Hoare, what the inspectors of the Quebec Bridge Company were doing with regard to the erection, if the responsibility was entirely on the Phœnix Bridge Company, and the inspectors of the Quebec Bridge Company only saw that the instructions prepared by the Phœnix Bridge Company were properly carried out by its own employees. They would seem to have been acting almost as inspectors for the Phœnix Bridge Company.

Mr. HOARE.—No, their duties were to inspect metal as it arrived, to see that it was in proper condition before going to the bridge site from the storage yard. They had to check over the different members with the plans to see that they were properly assembled and that each member was going to its proper position in the bridge. A great many of them, for instance, the large clusters of eye-bars, some of these eye-bars were so much alike that it was very easy, without careful inspection, to get the wrong eye-bars grouped in. All that work had to be carefully inspected, recorded, noted and permission given to the foremen to place those members in position. They had also to see that there were no misfits, to see that the proper spliced plates were attached, to see that the pins fitted, that the proper pins went into their right position, and to see that there was no inaccuracy in the bearings of the compression members—in fact to look out for any defects that might occur, that might have escaped the shop or occurred in transit. In several cases there were little shop errors discovered by our own inspectors, not important, trifling, many of them, but at the same time they were all recorded and trifling remedies had to be made, before some members could be connected. They had to see that the joints were properly bolted up until the riveting commenced, look after the riveting work, pass on every joint and every rivet.

Prof. KERRY.—Throughout that work they were proceeding in accordance with the plans prepared by the Phœnix Bridge Company and not approved or submitted to the Quebec Bridge Company?

Mr. HOARE.—They were submitted and approved by the consulting engineer and the Dominion engineer at Ottawa.

Prof. KERRY.—That is so far as the dimensions of the members are concerned, but not so far as concerns the detail of erection in any way.

Mr. HOARE.—Yes, that covered all the permanent members that went into the bridge. The approval, the certificate by the consulting engineers, and the government engineer covered every structural plan on the work, but the plans for travellers and hoisting machinery were not submitted to anybody for approval.

Prof. GALBRAITH.—If in the preliminary bolting up of spliced plates, you were not satisfied with the number and size specified in erection blue prints, did you consider it your duty to interfere?

Mr. HOARE.—Well, if I had been aware of it I should have interfered, but I have never been aware of any deficiency of that kind yet, the individual inspectors attended to all that. Those were matters of detail that they attended to in their daily course of inspection. That would not be mentioned to me at all, it would be simply noted in their diaries. If anything occurred of that kind they would take it up themselves and have it attended to and there is no reference necessary outside of that, that is part of their duty.

Prof. KERRY.—Had your inspectors any authority to alter the erection methods decided on by the Phœnix Bridge Company?

Mr. HOARE.—No, sir. Let me understand you, you are speaking of change of design in travellers and machinery?

Prof. KERRY.—Any detail which might come up in which the inspectors would consider that the work might be more safely carried out by following a different detailed method than that adopted by the Phœnix Bridge Company.

Mr. HOARE.—If they saw anything.

Prof. KERRY.—The point I want to get clear on is this, that in our understanding of the position of the chief engineer, every detail of the work is entirely subject to his approval, and he is directly responsible for the carrying out of every detail. I want to understand whether under the contract it was understood that that responsibility rested with the officials of the Phœnix Bridge Company or with the officials of the Quebec Bridge Company.

Mr. HOARE.—The Phœnix Bridge Company were primarily responsible for the erection methods, but if the inspectors on the work saw any unsafe proceedings taking place it would be their duty to report it to myself immediately.

Prof. KERRY.—But there was no preliminary study of those methods on the part of the Quebec Bridge Company.

Mr. HOARE.—No, not beyond the conferences already mentioned between the Phœnix Bridge Company's engineers and Mr. Cooper; we relied entirely upon them.

Prof. KERRY.—And with regard to the inspectors, if they had any objection to take they only had power to report and no power to act immediately; they could not order a change, they could only report to you and advise a change.

Mr. HOARE.—They could not order any change involving the design of the whole erection plant, they could simply report any defects they saw, they might order any little change in minor methods, such as calling attention to bad steel falls in a derrick or ropes or notice anything defective in a pulley block, &c.; little things like that they could order to be changed immediately, but they could not order any radical change in the layout of the important parts of the erection plant.

Prof. KERRY.—And the conferences with Mr. Cooper on which the Quebec Bridge Company was depending were entirely at the option of the Phœnix Bridge Company?

Mr. HOARE.—Yes.

Mr. HOLGATE.—You say that those inspectors could order those matters that they noticed to be rectified. Had they the power, Mr. Hoare, to enforce the carrying out of those orders?

Mr. HOARE.—Well, they tried to.

Mr. HOLGATE.—They were acting there as your deputies.

Mr. HOARE.—Acting there as my deputies.

Mr. HOLGATE.—As such they had that power?

Mr. HOARE.—I think they had.

Mr. HOLGATE.—Were there any considerations outside of professional ability that induced you to appoint Mr. McLure?

Mr. HOARE.—Would you repeat that again?

Mr. HOLGATE.—Was Mr. McLure, in other words, appointed because he was the best available man for that position that you could find?

Mr. HOARE.—He was appointed on the recommendation of Mr. Cooper.

Mr. HOLGATE.—The reason for asking this question is that the commission has been informed that Mr. McLure is a relative of yours.

Mr. HOARE.—I never knew him in my life before Mr. Cooper appointed him.

Mr. HOLGATE.—Mr. Hoare, what you have told us, we understand you to be an engineer of general knowledge, and that your professional work has led you through a varied and rather broad experience in construction and design.

Mr. HOARE.—Yes, that is right.

Mr. HOLGATE.—But there has not been placed before us any evidence that you assume to be an expert or an authority on bridge construction as a specialty.

Mr. HOARE.—No.

Mr. HOLGATE.—Now, will you tell us, was the appointment of a specially qualified bridge engineer, a man who would have had experience in the erection of large bridge structures, ever discussed? By that I mean a man of that broad experience in that special line and whose duty it would be to remain on the ground during the construction of this work—was the appointment of such a man ever discussed?

Mr. HOARE.—Not to my knowledge.

Mr. HOLGATE.—That was never discussed, to your knowledge?

Mr. HOARE.—No.

Mr. HOLGATE.—In your capacity did you ever make a recommendation that such a man should be appointed?

Mr. HOARE.—No.

Mr. HOLGATE.—In case that such an appointment were considered desirable or necessary, whose duty would it be to make that recommendation?

Mr. HOARE.—Myself.

Mr. HOLGATE.—And did you consider it unnecessary?

Mr. HOARE.—Quite.

Mr. HOLGATE.—Now you might give us your reasons for that.

Mr. HOARE.—Because Mr. Cooper was retained as consulting engineer for reference on all particulars. The Phœnix Bridge Company had full authority to use him in any respect, to refer to him and use him in any way, as he was employed by the Quebec Bridge Company for that purpose. Mr. Cooper was informed, sometimes daily, and always at the end of each week, of the daily progress of the work, and was always consulted on any question of importance that arose from time to time.

Mr. HOLGATE.—But Mr. Cooper was not on the ground?

Mr. HOARE.—No, he was in New York.

Mr. HOLGATE.—Was he ever on the ground during construction?

Mr. HOARE.—Yes.

Mr. HOLGATE.—No, I mean with regard to the erection of the steel work.

Mr. HOARE.—I do not think he has been more than once on the ground since the steel work was commenced.

Mr. HOLGATE.—Well, having Mr. Cooper as consulting engineer does not provide for the resident engineer watching the erection; it is a man of that description that I am inquiring about.

Mr. HOARE.—It was not Mr. Cooper's duty to be on the work.

Mr. HOLGATE.—Oh, I quite understand that, but Mr. Cooper in his capacity of consulting engineer could not take the place of a resident engineer.

Mr. HOARE.—Oh, no, he was informed sufficiently often, he was in thorough touch with the whole proceedings from week to week and day to day, he was kept in touch by the way the communications and reports were made. He knew what was taking place from day to day on that work.

Prof. KERRY.—Then we would understand, Mr. Hoare, that on a very great and necessarily dangerous work, that the Quebec Bridge Company was relying for its direction on a fully qualified man who could be described as permanently resident in New York and that the only evidence he had to guide him were the reports of Mr. McLure.

Mr. HOARE.—Yes, he had those reports, and he had the detailed statement of what occurred on the work at the end of each week, and, as I said before, daily, if anything unusual occurred. Would you repeat the question?

Question read to witness as follows :—

'Then we are to understand, Mr. Hoare, that on a very great and necessarily dangerous work, that the Quebec Bridge Company was relying for its protection on a

fully qualified man who could be described as permanently resident in New York and that the only evidence he had to guide him were the reports of Mr. McLure ?'

Mr. HOARE.—I do not know that the word dangerous—I do not know whether the work could be considered dangerous.

Prof. KERRY.—The answer to the general question, Mr. Hoare; is it a correct statement of facts? Kindly tell us if that is a correct statement of facts?

Mr. HOARE.—Yes, that is all right.

Mr. KERRY.—Was there any arrangement to provide for immediately reaching Mr. Cooper ?

Mr. HOARE.—The communications were by telegraph, mail or by special trips to his office.

Prof. KERRY.—Did you communicate to any extent directly with Mr. Cooper concerning the details of the work; I mean in addition to Mr. McLure's reports; were you in personal conference with Mr. Cooper frequently?

Mr. HOARE.—Yes, on my way to Phœnixville, I made it a point to call in and discuss matters generally.

Prof. KERRY.—But only at these times, Mr. Hoare ?

Mr. HOARE.—Occasionally I would write on some matter, some question or other that might occur, but the necessity for such communication did not often occur.

The witness retired.

JOSEPH ADOLPHE HUOT, sworn.

Mr. HOLGATE.—What is your position, Mr. Huot ?

Mr. HUOT.—Time-keeper.

Mr. HOLGATE.—For the ?

Mr. HUOT.—Phœnix Bridge Company.

Mr. HOLGATE.—Where is your place of employment ?

Mr. HUOT.—Over on the south side of the Quebec bridge.

Mr. HOLGATE.—Do you keep a record of the men employed by the company on the Quebec bridge?

Mr. HUOT.—Yes.

Mr. HOLGATE.—Can you say where the men were working on the bridge ?

Mr. HUOT.—They were divided in all parts of the bridge, some on the anchor arm, others on the cantilever arm, and others on the suspended span.

Mr. HOLGATE.—Can you separate those that were working on the various parts of the bridge ?

Mr. HUOT.—There were two gangs of riveters.

Mr. HOLGATE.—I want to know if you can.

Mr. HUOT.—Yes, sir; I can give it very close, I think.

Mr. HOLGATE.—Have you a list of the men who were at work on the 29th day of August ?

Mr. HUOT.—Yes, sir.

Mr. HOLGATE.—Have you it with you ?

Mr. HUOT.—This list is of all employees prior to August 30.

Mr. HOLGATE.—Does this list show the men who were in the employ of the company on the 29th of August ?

Mr. HUOT.—Yes, they are all on this; the names and occupations of all the men employed on that day are on this.

Mr. HOLGATE.—Just produce that list.

(List produced, filed and marked Exhibit No. 24.)

Mr. HUOT.—This includes north and south.

Mr. HOLGATE.—Were all of these men working on the 29th of August?

Mr. HUOT.—Some were not.

Mr. HOLGATE.—Can you separate those?

Mr. HUOT.—I guess I can.

Mr. HOLGATE.—Now?

Mr. HUOT.—On the bridge in the morning when I made the first count there were 117 working.

Mr. HOLGATE.—Does this list include men who were working on the north side as well as the south side?

Mr. HUOT.—Yes, sir, and also in the Belair storage yard.

Mr. HOLGATE.—A list is given showing the separation of these men?

Mr. HUOT.—Yes, sir, of their occupations.

Mr. HOLGATE.—So that down to and including 148 these men were all employed on the south side?

Mr. HUOT.—Yes, sir, but not all working that day.

Mr. HOLGATE.—Can you indicate on this list the men who were working on that day?

Mr. HUOT.—Yes, sir.

Mr. HOLGATE.—I wish you would do it.

Mr. STUART.—It would be shorter to eliminate those who were not.

Mr. HOLGATE.—Whichever is the shorter way.

Mr. HUOT.—Do you want the names of those who were working in the morning and did not work in the afternoon as well?

Mr. HOLGATE.—No.

Mr. HUOT.—Just those who were working in the entire——

Mr. HOLGATE.—We want those who worked that day; any man who worked that day. (Witness examined list and checked it over.) On this list of men that is numbered 24, what do the check marks mean?

Mr. HUOT.—Men who were at work on that day, at work in the morning.

Mr. HOLGATE.—On the south side?

Mr. HUOT.—Yes, sir.

Mr. HOLGATE.—Anything unusual happen that day?

Mr. HUOT.—Nothing that I know of.

Mr. HOLGATE.—I asked you if there was anything unusual happened that day in connection with the work?

Mr. HUOT.—About 5.31 in the afternoon the bridge collapsed.

Mr. HOLGATE.—Were you on it when it collapsed?

Mr. HUOT.—Yes, sir; I was about 75 feet.

Mr. HOLGATE.—75 feet.

Mr. HUOT.—Going out on the anchor arm. I had passed the second panel going out.

Mr. HOLGATE.—Were you on your way to land or outward?

Mr. HUOT.—Outwards. Each panel is 50 feet, and I was on the second panel going out.

Mr. HOLGATE.—Yes? You might describe exactly what you saw and what you did?

Mr. HUOT.—To say the truth, I saw very many things, but I cannot very well describe what I did see because I realized in a second that I was in danger, and I had to escape, and I made the best I could to escape myself.

Mr. HOLGATE.—And you turned around?

Mr. HUOT.—I turned around and jumped, and I ran up, and I had to run up the hill to make the approach span.

Mr. HOLGATE.—Yes.

Mr. HUOT.—And it happened that the sidewalk in the centre of the bridge all separated.

Mr. DAVIDSON.—From the falling of the bridge?

Mr. HUOT.—No, sir, they were all nailed down, and that is the way they were between the two spans.

Mr. HOLGATE.—When you passed along the anchor arm did you notice a space between the anchor arm and the adjoining approach span?

Mr. HUOT.—I just saw the portal bending towards the river.

Mr. HOLGATE.—Did you notice a gap between the end of the anchor arm and the approach span?

Mr. HUOT.—In fact I did not notice a gap. I felt it, because, as my feet were striking the planks they were going under me, so that there must have been a gap somewhere because the portal was leaning towards the river then.

Mr. HOLGATE.—Do you remember what was the very first thing that called your attention to this occurrence? What first attracted your attention?

Mr. HUOT.—The first thing that attracted my attention was the compressor pipe line breaking under me. That is what attracted my attention.

Mr. HOLGATE.—Where was the compressor pipe line?

Mr. HUOT.—It was running out on the centre, on the sidewalk, out to the front, to distribute air for the riveting hammers.

Mr. HOLGATE.—Was that laid at track level?

Mr. HUOT.—It was laid on the sidewalk.

Mr. HOLGATE.—Was that sidewalk at track level?

Mr. HUOT.—About track level.

Mr. HOLGATE.—And that broke?

Mr. HUOT.—It broke on the approach span. I just heard the crack as well as the crack of the bridge collapsing. I just turned around, and in turning around the pipe line passed alongside of me. That is what attracted my attention.

Prof. GALBRAITH.—Pulled away?

Mr. HUOT.—Yes.

Mr. HOLGATE.—Did it slide along on the track?

Mr. HUOT.—It did slide along on the track. It just moved up sideways, and I just had time to jump. When the pipe turned up on the side I jumped. To say the truth, I did not know anything in particular.

Mr. HOLGATE.—Was the pipe being pulled along the track? Was it passing the ties?

Mr. HUOT.—Yes.

Mr. HOLGATE.—In which direction was that moving?

Mr. HUOT.—Towards the front.

Mr. HOLGATE.—Towards the river?

Mr. HUOT.—The river. But this was so small an item—after the pipe line had passed I had just time to jump on the side of the pipe line and everything was gone. I ran to one side of the pipe line, but that is such a small item that I could not say much about it.

Mr. HOLGATE.—But the main fact is that you heard the pipe crack?

Mr. HUOT.—I heard the crack of the bridge.

Mr. HOLGATE.—And it was pulling forward?

Mr. HUOT.—I just heard the pipe and the crack of the bridge which was collapsing all at once.

Mr. HOLGATE.—Was the anchor arm also moving? Could you tell that?

Mr. HUOT.—No, I could not tell that.

Mr. HOLGATE.—But the pipe was moving along the anchor arm?

Mr. HUOT.—What attracted me as to the pipe was that the tank of air was full and that is what attracted me more than anything else. To say the truth I could not say that the pipe was exactly moving, but I know it broke somewhere.

Mr. HOLGATE.—Where did that pipe lead to?

Mr. HUOT.—It led to the front.

Mr. HOLGATE.—Was it secured to the bridge beyond the point where the break was?

Mr. HUOT.—It led from the air tank and ran out.

Mr. HOLGATE.—Where was the air tank ?

Mr. HUOT.—On the approach span on the extreme south.

Mr. HOLGATE.—Where was the pipe laid ?

Mr. HUOT.—It was laid down on the sidewalk.

Mr. HOLGATE.—What was the size of the pipe ?

Mr. HUOT.—Two and a half or three inches.

Mr. HOLGATE.—That pipe was for what purpose ?

Mr. HUOT.—For distributing air to the hammers.

Mr. HOLGATE.—Where were the hammers working ?

Mr. HUOT.—The riveters ?

Mr. HOLGATE.—Yes.

Mr. HUOT.—There were two gangs on the anchor arm, one gang on the main post and the balance were at the front. There were eight gangs altogether.

Mr. HOLGATE.—Where were the balance ?

Mr. HUOT.—On the cantilever arm.

Prof. GALBRAITH.—Repeat that, please.

Mr. HUOT.—There were two riveting gangs on the anchor arm, one on the main post and the other five gangs were out on the cantilever arm.

Mr. HOLGATE.—Can you, from this list (exhibit No. 24) indicate where the men on this list were working at the time of this accident ?

Mr. HUOT.—Maybe I could not, because on the bridge certain men may be together at one place and in five minutes they will be 50 or 100 feet apart.

Mr. HOLGATE.—Is there anybody who could locate these men ?

Mr. HUOT.—I do not know.

Mr. HOLGATE.—Could you, with the assistance of others, locate them ?

Mr. HUOT.—In what way do you want them located ?

Mr. HOLGATE.—Showing where they were working at the time of this accident.

Mr. HUOT.—Yes, I can do that approximately.

Mr. HOLGATE.—We understand that some of these men lost their lives.

Mr. HUOT.—Yes, sir.

Mr. HOLGATE.—In connection with the survivors we would like you to indicate on this sheet (exhibit No. 24), with a red mark, the survivors and to absolutely locate where each of these men was at the time of this accident. Can you do that with the assistance of any of the men that are here ?

Mr. HUOT.—Yes, I might.

Mr. HOLGATE.—Can you do that by two o'clock ?

Mr. HUOT.—I think I can.

Mr. HOLGATE.—Well, then, if you can do that, Mr. Huot, between now and two o'clock to-day it will assist us.

Mr. HUOT.—It is quite a lot of work to do that.

Mr. HOLGATE.—There are some men here who perhaps could help you out.

Mr. HUOT.—These men that are here I know where they were, except one or two; they were not working.

Mr. HOLGATE.—There is another question I want to put. Some of these men who were not survivors were not working at that time?

Mr. HUOT.—Yes, sir.

Mr. HOLGATE.—We want those separated from the others.

Mr. HUOT.—Do you want to mark on this list all these different separations ?

Mr. HOLGATE.—You are not an engineer ?

Mr. HUOT.—No, sir.

Mr. HOLGATE.—But in the course of your work you would have to visit the various portions of the structure ?

Mr. HUOT.—No, sir. You only pass through to see that the men are all there and check the men up.

Mr. HOLGATE.—In doing that, did you check them where they were working ?

Mr. HUOT.—I checked them sometimes where they were working and other times I would see them going out.

Mr. HOLGATE.—In order to do that you would have to travel over the bridge?

Mr. HUOT.—No, I did not need to.

Mr. HOLGATE.—You had to at times?

Mr. HUOT.—I had to a very few times.

Mr. HOLGATE.—Have you, of your own knowledge, any information regarding any defect that existed?

Mr. HUOT.—None at all.

Prof. GALBRAITH.—How long had you been on the bridge before the accident?

Mr. HUOT.—I left the office at a quarter to five to go out and I came back.

Prof. GALBRAITH.—The office is at the end of the bridge?

Mr. HUOT.—At the south end of the approach span.

Prof. GALBRAITH.—You say that you did not find it necessary to go on the bridge often? What were you doing on it that day?

Mr. HUOT.—I was supposed to go at least four times a day to check up my men.

Prof. GALBRAITH.—It was your ordinary duty?

Mr. HUOT.—That was my ordinary duty and I could take myself the best way I could to save my time.

Witness retired.

Mr. HOARE, recalled.

Mr. HOLGATE.—Prior to the collapse of the bridge had anything abnormal or unexpected occurred during the construction which, in your opinion, required the special attention of an engineer of special qualifications as a bridge engineer?

Mr. HOARE.—My answer I have written out as follows:—I may say that the work of erection followed an entirely normal course. The tests made showed the deflection expected occurred, and the whole construction up to the time of the collapse followed the anticipated course. I was myself frequently on the works and it never occurred to me that with my long experience I was not absolutely qualified to superintend the construction of the bridge and I still think so. If anything abnormal had occurred I should have sent for Mr. Cooper, but nothing suggesting the slightest danger to the bridge occurred and I do not now see what difference Mr. Cooper's presence here during construction would have made.

Mr. HOLGATE.—May not, in a work of this nature, Mr. Hoare, abnormal and unexpected conditions arise at any moment? I am speaking of a structure of this nature. May not they arise at any moment?

Mr. HOARE.—It is quite possible.

Mr. HOLGATE.—Is it not a thing that you might almost expect?

Mr. HOARE.—No, I would not say that.

Mr. HOLGATE.—At any rate, if you would not go so far as to expect them, would you not prepare for them?

Mr. HOARE.—I consider that we prepared for them.

Mr. HOLGATE.—Then when you did send to Mr. Cooper you considered the question abnormal?

Mr. HOARE.—No, I would not say that. We made a practice of keeping Mr. Cooper thoroughly posted on everything that occurred from day to day.

Mr. HOLGATE.—I quite appreciate that, but Mr. Cooper, understand, could not come to the bridge.

Mr. HOARE.—No, and I considered that it was not necessary.

Mr. HOLGATE.—Is there anything you want to say?

Mr. HOARE.—No, I do not think so. It was only to make that a little more clear. It left it in rather an indefinite position.

The Commission took recess.

AFTERNOON SESSION—FOURTH DAY.

The Commission resumed at two p.m.

Mr. CUDWORTH, recalled.

Mr. HOLGATE.—There is a tracing here, Mr. Cudworth, without any title and without any date on it. Can you tell us what this is ?

Mr. CUDWORTH.—This is a tracing furnished by the Quebec Bridge Company from which to locate a few points to use in the investigation,—to locate them on the plans.

Mr. HOLGATE.—What does the plan show ?

Mr. CUDWORTH.—Part of it upon which I have worked is to show the position of the dock, the path and the road from the highway to the bridge near the beach; also the location of derricks, of a tree and the point where a man stood who observed the fall of the bridge.

Mr. HOLGATE.—Does it show the position of the bridge also in relation to these other things ?

Mr. CUDWORTH.—Yes, sir. That was put on before the plan came to me.

Mr. HOLGATE.—Generally speaking, is the plan correct ?

Mr. CUDWORTH.—As far as I know the plan is correct.

Mr. HOLGATE.—Did you assist in making the survey ?

Mr. CUDWORTH.—Yes, sir, and plotting it in pencil. That is this survey only of the additions ; not of the plan as it came originally to us from the Quebec Bridge Company.

Mr. HOLGATE.—Generally speaking, the plan is a correct one in that it shows the relative positions of the various points in respect to the bridge itself ?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—When was this survey made ?

Mr. CUDWORTH.—You mean the part that we worked on ?

Mr. HOLGATE.—Yes.

Mr. CUDWORTH.—I could not give you the date of that without referring to my notes at the bridge.

Mr. HOLGATE.—Was it made since the day of the accident ?

Mr. CUDWORTH.—Yes, it was made since the accident. (Plan put in and filed and marked Exhibit No. 25).

Mr. HOLGATE.—Here is a white print of a plan, Mr. Cudworth. What generally, does this indicate ?

Mr. HOLGATE.—That is called by us the general line plan of the bridge. We refer to it as the general plan.

Mr. HOLGATE.—Does it show the anchor arm ?

Mr. CUDWORTH.—Yes, sir, it shows the anchor arm, the cantilever arm and half of the suspended span.

Mr. HOLGATE.—Do you recognize this as a plan that was used in connection with the work ?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE.—As showing generally, what ?

Mr. CUDWORTH.—Showing the general dimensions, clearance, width and height of waterway.

Mr. HOLGATE.—Level of span ?

Mr. CUDWORTH.—Yes, sir.

Mr. HOLGATE. The designation of the various parts of the bridge as far as the plan goes ?

Mr. CUDWORTH.—Yes, not fully but as far as the plan goes. I might state that this is the normal diagram.

Prof. KERRY.—You may say that this plan is not lettered to correspond with the erection diagrams ?

Mr. CUDWORTH.—Most of the numbers correspond, but not all of them.

Prof. KERRY.—In some cases the lettering is changed.

Mr. CUDWORTH.—The marks are not necessarily the same; in fact they are not the same as those used in the erection—not in all cases the same.

Mr. HOLGATE.—Is there a similar plan to this with the exactly correct marking on ?

Mr. CUDWORTH.—No, sir, not to my knowledge.

Mr. HOLGATE.—Could you re-mark the portions of this plan that do not agree with the other erection diagram ? We want to get a plan on a good large scale ?

Mr. CUDWORTH.—Yes, sir.

J. HUOT recalled.

Mr. HOLGATE.—Have you got that information ?

Mr. HUOT.—Yes, sir.

Mr. HOLGATE.—You had better state what the blue marks opposite the names of the men on Exhibit 24 mean.

Mr. HUOT.—The blue marks mean the survivors who were not working at the time of the accident.

Mr. HOLGATE.—And what do the red marks mean ?

Mr. HUOT.—It means the survivors who were working at the time of the accident and the exact location of each man as near as we could make it out.

Mr. HOLGATE. Then this to the best of your knowledge is correct ?

Mr. HUOT.—Yes, sir.

The witness retired.

E. J. WICKIZER, sworn.

Prof. KERRY.—what was your position on the work, Mr. Wickizer ?

Mr. WICKIZER.—Foreman of preparations, such as putting up false work and foundations.

Prof. KERRY.—That is both on the work on the south shore and the work on the north shore ?

Mr. WICKIZER.—Yes, sir, since June, 1904.

Prof. KERRY.—So you did not have to work on the installation of the span itself?

Mr. WICKIZER.—No, sir.

Prof. KERRY.—What was the last date that you were out on the work on the south shore, Mr. Wickizer ?

Mr. WICKIZER.—I could not give you that date.

Prof. KERRY.—Approximately ?

Mr. WICKIZER.—Well probably about the 10th of August.

Prof. KERRY.—At the time of the accident you were where?

Mr. WICKIZER.—On the west side, right opposite the bridge.

Prof. KERRY.—Out on the false work?

Mr. WICKIZER.—No, sir, I was on the dock right by the main pier, probably 50 feet back of the main pier to the east.

Mr. HOLGATE.—Will you tell us any details of the accident you had opportunities to observe, what you actually saw?

Mr. WICKIZER.—Well, when the span started to fall the first thing that I looked at was the main pier and I noticed that the plates on the main post, probably 20 feet above the shoe, seemed to be rolling up and next my eyes went to the front and the front was moving slowly, probably 75 feet below the level line of the floor, and about that time the main post seemed to be going and the back part did not seem to move

any but a little bit forward towards the north side. That is my view and when she got about I should say 35 or 40 feet from the water it all seemed to collapse and go sudden. Before that in my sight it was very slow, it just kind of gradually——

Mr. HOLGATE.—What first attracted your attention?

Mr. WICKIZER.—A kind of grinding noise.

Mr. HOLGATE.—The sound of the——

Mr. WICKIZER.—Yes, sir, and also the men shouting.

Mr. HOLGATE.—So that practically the accident had already taken place before you had an opportunity to observe it.

Mr. WICKIZER.—Yes, sir.

Mr. HOLGATE.—Do you know at all what material was on the span at the time of the accident, Mr. Wickizer?

Mr. WICKIZER.—What material?

Mr. HOLGATE.—Yes, was piled up there ; had you an opportunity of knowing it ?

Mr. WICKIZER.—For erection do you mean?

Mr. HOLGATE.—Yes?

Mr. WICKIZER.—There was one set of bars that I could see on the cars on the east side on the erection girders that is used for erection on two cars, that I could see plainly and the others I could not see, they were not to the front yet.

Mr. HOLGATE.—You had not been on the span recently?

Mr. WICKIZER.—I were not very familiar with that part of the work because it was out of my business altogether, because I only had charge of looking after the preparations on the north side, therefore, the erection did not concern me, just from a practical standpoint to see what I could see and learn.

Prof. GALBRAITH.—You said, Mr. Wickizer, that your attention was first called to the centre posts?

Mr. WICKIZER.—Yes.

Prof. GALBRAITH.—Failing at a place about 20 feet above the floor?

Mr. WICKIZER.—Yes, that is judging the distance from where I stood.

Prof. GALBRAITH.—And that the plates seemed to have rolled up?

Mr. WICKIZER.—Yes, a kind of tendency to crush as it was going down.

Prof. GALBRAITH.—These plates at the side that you saw twist?

Mr. WICKIZER.—It seemed to be rolling.

Prof. GALBRAITH.—Sideways?

Mr. WICKIZER.—Yes, sideways.

Prof. GALBRAITH.—Not from the west, not towards you.

Mr. WICKIZER.—Yes, there was a tower and that shoved off on the up side first, on the west side first.

Prof. GALBRAITH.—Will you yourself draw the appearance of those plates after they had been disturbed, just draw a line to show what you mean?

Mr. WICKIZER.—It looked to me from where I stood as though it was going to roll up and crush down.

Prof. KERRY.—Were the main posts still plumb at that time?

Mr. WICKIZER.—Yes, sir, they appeared to be settling down very slowly at the top, they seemed to be very level.

Prof. GALBRAITH.—The post was falling towards you?

Mr. WICKIZER.—They seemed to be a little bit towards me, enough that I could notice it standing in a direct line.

Prof. GALBRAITH.—You could hardly see that?

Mr. WICKIZER.—Of course I was 1800 feet from where these were.

Prof. GALBRAITH.—What was the appearance of the failure as you noticed it, about you say 20 feet above the floor?

Mr. WICKIZER.—The posts seemed to be crushing.

Prof. GALBRAITH.—Now you are sure there were plates on these sides, there was not lattice work or anything of the kind, plates?

Mr. WICKIZER.—Well, of course, you cannot be positive 1,800 feet——

Prof. GALBRAITH.—But you do not remember the construction, I have not the drawings here.

Mr. WICKIZER.—1,800 feet is a very long vision.

Prof. GALBRAITH.—The plates on the east and west sides seemed to curl over at the fracture? Is that what you said?

Mr. WICKIZER.—Yes, sir.

Prof. KERRY.—Referring to your general work did you generally carry out your day's work following the diagram supplied from the Phœnix office?

Mr. WICKIZER.—Yes, sir, to the letter.

Prof. KERRY.—You were working more to diagrams than to the personal directions of Mr. Yenser?

Mr. WICKIZER.—Yes, sir, working to plans.

Prof. KERRY.—And you found the plans to be entirely satisfactory and full?

Mr. WICKIZER.—Yes, sir.

Prof. KERRY.—That they gave you all the information you required for the purpose?

Mr. WICKIZER.—Yes, sir, my instructions were to follow them out, the plans, to make no changes whatever.

Prof. KERRY.—Those would be instructions from Mr. Yenser?

Mr. WICKIZER.—This was my instructions from the Phœnix Bridge Company whose foreman, Mr. Yenser, was on the work.

Prof. KERRY.—I see.

Mr. WICKIZER.—That was also my instructions from Mr. Milliken the second time I came here on the north side. Of course to that part of it I never had any instructions from Mr. Yenser at all, although he was my superior, but that instruction came from Mr. Milliken.

Mr. HOLGATE.—Mr. Davidson, can you suggest any questions to ask from Mr. Wickizer?

Mr. DAVIDSON.—No.

Mr. HOLGATE.—Mr. Stuart, is there any that you wish to have asked?

Mr. STUART.—No.

Witness discharged.

C. L. CULBERT sworn.

Prof. GALBRAITH.—Were you at work the day of the accident?

Mr. CULBERT.—No, sir, I was not.

Prof. GALBRAITH.—Where were you?

Mr. CULBERT.—Standing up along the river shore.

Prof. GALBRAITH.—At the time of the accident?

Mr. CULBERT.—At the time of the accident, yes, sir.

Prof. GALBRAITH.—This is a plan showing the location of the bridge (Exhibit 25) and the shore.

Mr. CULBERT.—I believe I understand that thoroughly.

Prof. GALBRAITH.—Show me on this diagram where you were standing at the time of the accident?

Mr. CULBERT.—Just about here, where the road turns in to meet the other little bit of an air cut, (marked 'A' on Exhibit 25).

Prof. GALBRAITH.—Were you standing still?

Mr. CULBERT.—No, we were walking down.

Prof. GALBRAITH.—Which way?

Mr. CULBERT.—Toward the bridge, just on the point of the road, the turn.

Prof. GALBRAITH.—What first called your attention to the accident?

Mr. CULBERT.—Why, the first thing I saw was something up on the anchor arm,

what it was I do not know; it looked to me just more like a flash of smoke than anything else I can compare it to, it was something up there.

Prof. GALBRAITH.—On what part of the top?

Mr. CULBERT.—On the extreme top or chord.

Prof. GALBRAITH.—At the top chord?

Mr. CULBERT.—On the top of the top chord.

Prof. GALBRAITH.—Did that appear clear against the sky line?

Mr. CULBERT.—No, it appeared to be right on the chord.

Prof. GALBRAITH.—Which chord, the east or the west?

Mr. CULBERT.—On the top chord, the Montreal chord.

Mr. DAVIDSON.—The west?

Mr. CULBERT.—On the Montreal side.

Prof. GALBRAITH.—On the Montreal side, the west chord?

Mr. CULBERT.—Yes.

Prof. GALBRAITH.—That would be the chord which would seem highest against the sky?

Mr. CULBERT.—Well, what I mean, it was right on these chords, I do not know which chord it was on.

Prof. GALBRAITH.—What I want to get you to say is whether it was the highest point against the sky on that bridge at that place.

Mr. CULBERT.—Well, it was in the highest point I could see, but it might have been back over the edge of that highest point.

Prof. GALBRAITH.—Now, can you locate the position lengthwise of the bridge, of that appearance, of that smoke? Have you any means of fixing the position on the bridge, can you point it out on this plan?

Mr. CULBERT.—I do not know whether I could or not, because it started there and the excitement coming so quick I do not know just what spot it was, I know it was somewhere near the centre.

Prof. GALBRAITH.—Near the centre of the anchor arm?

Mr. CULBERT.—Near the centre of the anchor arm.

Prof. GALBRAITH.—Did you make any attempt to get the line of it?

Mr. CULBERT.—In what way, afterwards?

Prof. GALBRAITH.—Afterwards or at the time?

Mr. CULBERT.—I went down there afterwards to see if I could see anything broken or anything in that line, and I could not see anything that I can think could possibly break up there. I thought for a while it might be a flash of electricity. I am undecided in my own mind what it was.

Prof. GALBRAITH.—This is the tree which you pointed out to Mr. Holgate and myself on the ground (tree marked 'B' on exhibit 25)?

Mr. CULBERT.—Yes.

Prof. GALBRAITH.—Can you show on the plan the direction in which you saw this appearance on the bridge by means of that tree, can you show which side of that tree it was on?

Mr. CULBERT.—Why, I do not know; it seemed to me on the left hand side of the tree as I was looking up. Of course that tree did not obstruct anything, that tree was entirely too low.

Prof. GALBRAITH.—It seemed to you to be on the left hand side?

Mr. CULBERT.—A little on the left of the tree.

Prof. GALBRAITH.—The side towards the river.

Mr. CULBERT.—The side towards the river from where I was standing.

Prof. GALBRAITH.—How far would you estimate that distance, 10 feet, 20 feet, 30 feet, 50 feet?

Mr. CULBERT.—I could not give much of an estimation of it, because it is something I am not exactly sure of.

Prof. GALBRAITH.—What did you do as soon as you saw this smoke on the bridge?

Mr. CULBERT.—As soon as I saw the smoke on the bridge I just started out; at first that anchor arm seemed to rise up a little.

Prof. GALBRAITH.—At what place?

Mr. CULBERT.—It seemed to rise generally all around the centre of it.

Prof. GALBRAITH.—And then?

Mr. CULBERT.—A fellow was with me, I said: There she goes and I started for the bridge.

Prof. GALBRAITH.—How do you mean?

Mr. CULBERT.—I started to run towards it, yes, and it just began to crash and rumble——

Prof. GALBRAITH.—What was the name of the man with you?

Mr. CULBERT.—I believe his name is Chase or Hase. He is sitting over there.

Prof. GALBRAITH.—Did you look towards the cantilever span?

Mr. CULBERT.—Why, I remember distinctly seeing somebody running towards the shore.

Prof. GALBRAITH.—I did not mean that, did you look at the cantilever span, did you see it fall?

Mr. CULBERT.—No, I did not, I did not see it hit the ground.

Prof. GALBRAITH.—Hit the water?

Mr. CULBERT.—The cantilever, oh, we saw that hit the water.

Prof. GALBRAITH.—You saw it?

Mr. CULBERT.—I got my eye on it just about the time it hit the water. I was watching the fellow running to the shore and I was running at the same time myself.

Prof. GALBRAITH.—You think then, to sum up, that the appearance that called your attention to the bridge, was an appearance of haze near the upper chords about the centre of the anchor arm?

Mr. CULBERT.—Yes, sir.

Prof. GALBRAITH.—Do you recognize this drawing of the bridge (Exhibit 26)?

Mr. CULBERT.—Yes, I recognize that.

Prof. GALBRAITH.—Could you point out on this plan whereabouts you saw that burst of haze or smoke?

Mr. CULBERT.—It was some place in around here in the centre, I could not point cut the exact spot to you, it was near the centre.

Prof. GALBRAITH.—Do you know of any defects in the bridge before it fell?

Mr. CULBERT.—Not that I personally saw. I heard speak of them but I did not see them. There was some defects there, I do not know if you would call them defects or not, but it would try a man's courage when they were dropping anything from the traveller to the span you could feel it give.

Prof. GALBRAITH.—And return?

Mr. CULBERT.—Oh, yes.

Prof. GALBRAITH.—The spring?

Mr. CULBERT.—The spring of it; it seemed to me a little more than it ought to be.

Mr. HOLGATE.—Did you work out there?

Mr. CULBERT.—Yes.

Mr. HOLGATE.—Did you continue work after you noticed that?

Mr. CULBERT.—Everybody worked. Us fellows work as long as there is anything to stand on.

Prof. GALBRAITH.—Did you see any bending during the accident, at the time of and during the accident, in either lower or upper chord? Any change of shape in either lower or upper chord?

Mr. CULBERT.—I saw this cantilever arm start down; of course it changed all kinds of shapes; just a mass of rumbling roar, and that electricity.

Prof. GALBRAITH.—You saw all sorts of changes, you say?

Mr. CULBERT.—The biggest part of everything was blurred in the electricity.

Prof. GALBRAITH.—What do you mean, 'in the electricity ?'

Mr. CULBERT.—The electricity wires got to flashing, you can see blue fire all over the business. There was a lot of smoke and that would naturally attract a man's attention to that, it was something flashy.

Prof. GALBRAITH.—You could not point to any particular chord or position where any bending took place ?

Mr. CULBERT.—I could not.

Mr. HOLGATE.—Did you look for any such ?

Mr. CULBERT.—No, sir, I did not. No such ideas as that were in my head, my idea was to get down as quick as I could to see if I could get anybody out who was crippled or injured. What first attracted my attention when I saw this was a boat sitting at one side there and my idea was to get that boat and get into the river.

Witness discharged.

RICHARD CHASE, sworn.

Prof. GALBRAITH.—Mr. Chase, you were walking with the last witness, Mr. Culbert, at the time the accident occurred ?

Mr. CHASE.—Yes, sir.

Prof. GALBRAITH.—Do you confirm his statements, are his statements correct?

Mr. CHASE.—Well, I could not say; of course I was looking in a different direction altogether from him.

Prof. GALBRAITH.—What did you see ?

Mr. CHASE.—I just saw the towers fall down and I saw the big traveller tip up and the first glance I saw the engine; I looked straight at the post and saw the engine tip out, that is the first thing I saw.

Prof. GALBRAITH.—You looked then at the part of the bridge from the main pier outwards towards the river ?

Mr. CHASE.—Outwards towards the river, I did not look at the anchor arm, I did not see it, it was down before I took a glimpse at it.

Prof. GALBRAITH.—Which way did the towers fall ?

Mr. CHASE.—The tower first as I saw it, the top was towards the north shore and then all of a sudden it kind of kicked back and fell.

Prof. GALBRAITH.—What was the first motion of the towers that you noticed?

Mr. CHASE.—The first motion of the towers that I noticed was just a bend over and the top went over about 20, about 30 feet and then dropped.

Mr. HOLGATE.—To the north ?

Mr. CHASE.—Yes, sir, to the north shore.

Prof. GALBRAITH.—Then the whole thing went suddenly ?

Mr. CHASE.—The whole thing went suddenly.

Prof. GALBRAITH.—And the lower part of the towers kicked backwards?

Mr. CHASE.—Kicked back and fell right in a heap.

Mr. GALBRAITH.—Of both towers ?

Mr. CHASE.—Both towers.

Prof. GALBRAITH.—What sort of motion was it, what I mean is this : Was it slow at first and afterwards did it go very suddenly or was it gradual through the whole fall ?

Mr. CHASE.—It went very slow at first until it got started, and then she went down in a heap. She went very slow and then fell down very quickly. I did not have time to see much of the cantilever arm, after it got down I did not see it, but the big traveller just fell right over, the big traveller.

Prof. GALBRAITH.—Did the cantilever seem to crumble up or did it keep its whole length?

Mr. CHASE.—It kept its whole length according to what I could see, kept its whole length and hit the water.

Prof. GALBRAITH.—You saw the outer end hit the water?

Mr. CHASE.—Not the outer end, it was in the water before I saw it, I just saw the top of the traveller.

Prof. GALBRAITH.—If the outer end was in the water before you saw it, how did you see the top of the bridge fall slowly?

Mr. CHASE.—I was going by the tower.

Prof. GALBRAITH.—You were not watching the river end?

Mr. CHASE.—No, I did not watch it; I had my sight on the towers all the time.

Prof. GALBRAITH.—You never then saw any of the cantilever arm touch the water?

Mr. CHASE.—No, sir.

Prof. GALBRAITH.—And when you said that that seemed to keep straight you referred to the tower and not to the cantilever arm?

Mr. CHASE.—I could not see the end of it touch the water, but I saw the pier end all the time; the bottom chord——

Prof. GALBRAITH.—The bottom chord of the cantilever end——

Mr. CHASE.—was straight all the time.

Prof. GALBRAITH.—And how far out from the pier did you see the bottom chord?

Mr. CHASE.—About two panels.

Prof. GALBRAITH.—How was it you did not see more?

Mr. CHASE.—I guess because I saw it and as soon as I saw it I began to run, and I had to take glimpses as I ran on account of the stones. I could not look at the stones and the bridge at the same time.

Prof. GALBRAITH.—How long after you noticed the accident was it before it was over?

Mr. CHASE.—Oh, I should judge about three minutes from the time it struck the water until all the swells and everything was all over.

Prof. GALBRAITH.—I mean how long was the bridge in going down?

Mr. CHASE.—That went down I should judge in about seven or eight seconds after it got started.

Prof. GALBRAITH.—While I hold this watch will you tell me when you think the same amount of time has elapsed?

Mr. CHASE.—I should judge about now.

Prof. GALBRAITH.—That is about four seconds.

Mr. CHASE.—That is about how long. I was walking towards the bridge, and I was walking on the river side, and had my hands in my pockets, and Culbert and I as we were walking were discussing how many more panels were to be put in and he said, 'no, there ain't any more,' and I heard the bridge and looked around, I turned around and saw the engine shoot to the end, about one panel.

Prof. GALBRAITH.—You saw the engine shoot how far?

Mr. CHASE.—About one panel, about 50 feet.

Prof. GALBRAITH.—How far from the pier was the engine?

Mr. CHASE.—The engine when I saw it was one panel from the pier; I could not say whether it was going in or out. She was on the cantilever arm, one panel out, about fifty feet from the pier.

Prof. GALBRAITH.—And how far did you see her move?

Mr. CHASE.—She shot one panel more.

Prof. GALBRAITH.—Towards the water?

Mr. CHASE.—Towards the water.

Prof. GALBRAITH.—Did both towers appear to go together?

Mr. CHASE.—Well, that I could not say. After I had my eyes on the tower I looked at the bottom and saw it kick out, and I could not say after it touched the ground whether they got down together or not, I could not say. I did not have my mind quite down then, I was a little nervous.

Prof. KERRY.—Did it strike the ground before it started to crumple up badly?

Mr. CHASE.—Well, I could not say that either.

Prof. GALBRAITH.—Did the tower drop as a whole or was it broken before it fell?

Mr. CHASE.—I could not say it was broken either, because when I saw the tower first, it was standing up straight and along for about 30 feet it went slowly and then kicked back and fell all of a sudden, crash down the piers.

Prof. GALBRAITH.—I understand, you did not say this in your evidence, but this is my understanding of it, that you did not see more of that bridge while it was falling than perhaps from a panel behind the main pier to two or three panels forward of the main pier?

Mr. CHASE.—Two panels before the main pier, that is on the suspension arm, but I did not take notice of anything back of the pier on the anchor arm.

Prof. GALBRAITH.—You said you saw the tower kick back?

Mr. CHASE.—I saw the tower kick back but I did not see it kick on the anchor arm.

Prof. GALBRAITH.—You watched only about one or two panels of the cantilever arm next the tower during the accident?

Mr. CHASE.—Yes, sir.

Prof. GALBRAITH.—Do you know of any defects in the material or construction of the bridge of your own knowledge?

Mr. CHASE.—No, sir, I do not; but I saw a lot of engineers and all the bosses on the bottom chord on the suspension arm, on the cantilever, I should say the first panel out on the Quebec side from the tower; I saw a gang of the inspectors there and the bosses and all and I was working on the shoe with a man named LaChapelle.

Prof. GALBRAITH.—What is the nature of your duties?

Mr. CHASE.—I was in the scaffold gang, hanging scaffolds for the riveters.

Prof. GALBRAITH.—And how long had you been in the employment of the company?

Mr .CHASE.—I should judge going on six months now, it is more than six months, I started this job the 10th of May when they opened up.

Prof. GALBRAITH.—You were not working the morning of the accident?

Mr. CHASE.—Yes, sir.

Prof. GALBRAITH.—Oh, you were working the morning of the accident?

Mr. CHASE.—Yes, sir.

Prof. GALBRAITH.—At what place were you working then?

Mr. CHASE.—On the main post, half way up on the main post.

Prof. GALBRAITH.—How high up?

Mr. CHASE.—I should judge about 50 feet.

Mr. HOLGATE.—Is that the centre post?

Mr. CHASE.—Yes, I was out on a small strut on the cantilever side, the riveters were letting a scaffold down.

Mr. HOLGATE.—Did you work steadily on the bridge or did you often take a day off?

Mr. CHASE.—Oh, I took a day off once in a while, but I was pretty steady on the bridge. Only the wind stopped me once in a while, when it was too strong I did not like to work on the bridge, the wind being too strong.

Mr. HOLGATE.—And in the time that you were employed on that bridge you never noticed anything that you would call a defect in the bridge?

Mr. CHASE.—I saw one, but we had mended that, me and the boss riveter, we had to put a plate over that. But that was, I could not say what month that was in, now.

Mr. HOLGATE.—Where was that place?

Mr. CHASE.—That was on the anchor arm, I could not say, it was the fourth or fifth post from the pier.

Mr. HOLGATE.—Counting from the pier?

Mr. CHASE.—From the pier, from the towers.

Mr. HOLGATE.—From the main towers, the centre posts?

Mr. CHASE.—There was a break in the iron and we put a plate over it.

Mr. HOLGATE.—What plate was broken?

Mr. CHASE.—A plate that held the ladels post and chord together.

Mr. HOLGATE.—Had the old plate been taken off and a new plate put on, or had the plate, the broken plate, simply been repaired?

Mr. CHASE.—Just put a little piece on top of her.

Mr. HOLGATE.—Was it a heavy plate?.

Mr. CHASE.—Oh I guess about a half inch plate.

Mr. HOLGATE.—When was that?

Mr. CHASE.—I could not say; it was in June or July, I think in some part of July.

Mr. HOLGATE.—That is the only defect that you ever knew of to your own knowledge?

Mr. CHASE.—Yes, sir.

Prof. KERRY.—You were working on the main posts, Mr. Chase?

Mr. CHASE.—Yes, sir, that morning.

Prof. KERRY.—Were you working near the bottom of the main post?

Mr. CHASE.—No, about 50 feet above the deck.

Prof. KERRY.—How long was it since you were working near the foot of the main post?

Mr. CHASE.—I should judge, well somewheres, the day before, I think Tuesday or Wednesday I was working at the shoe.

Mr. HOLGATE.—You have heard the statement that one of the plates right close to the shore there was cracked?

Mr. CHASE.—I heard something about it. I was working down there once with the boss riveter and he spoke of it, and just then the whistle blew and I did not notice.

Prof. KERRY.—You do not know it was cracked and do not know it was not?

Mr. CHASE.—I do not. It might have been cracked, as he said it was cracked, but I never saw it.

Prof. KERRY.—Who told you?

Mr. CHASE.—Alexander Ouimet.

Prof. KERRY.—Was he the man you were working with?

Mr. CHASE.—No, but I happened to be down there.

Prof. KERRY.—Who was the boss riveter?

Mr. CHASE.—Slim Meredith. I do not know his first name, all I know is Slim Meredith.

Mr. STUART.—He is not able to localize the place where the mended plate was.

Prof. GALBRAITH.—About what post was that?

Mr. CHASE.—I do not know whether it was the fourth or fifth panel post from the main tower out on the Quebec side.

Prof. GALBRAITH.—About the fourth or fifth post from the main towers and on the Quebec side.

Mr. CHASE.—On the Quebec side.

Prof. KERRY.—And on the anchor arm?

Mr. CHASE.—On the anchor arm.

Prof. GALBRAITH.—And on the anchor arm, that is the Quebec side, the down river side?

Mr. CHASE.—Yes, sir.

Witness discharged.

JOSEPH LEFEBVRE, sworn.

The witness expressed a desire to testify in French.

Mr. G. G. STUART, K.C., being sworn, acted as interpreter.

Prof. GALBRAITH.—What was your job on the bridge, Mr. Lefebvre?

Mr. LEFEBVRE.—Day labourer.

Prof. GALBRAITH.—How long have you been employed on the bridge?

Mr. LEFEBVRE.—Seven or eight months working on the bridge.

Prof. GALBRAITH.—Were you working on the bridge on the day of the accident?

Mr. LEFEBVRE.—Yes. I was working underneath the bridge the day of the accident about 30 feet higher up in the Montreal direction than the bridge and about 100 feet from the anchor arm. I was out from under the bridge about 30 feet and 100 feet up from the anchor arm. I was working really on the beach.

Prof. KERRY.—100 feet from the main pier?

Mr. LEFEBVRE.—The main pier is the extreme outside; about 400 or 500 feet from the main pier.

Prof. GALBRAITH.—Near the anchor pier?

Mr. LEFEBVRE.—About 100 feet from the anchor pier.

Prof. GALBRAITH.—What did you see at the time of the accident?

Mr. LEFEBVRE.—I heard a loud noise and I looked up and then saw the bridge slowly sinking. I then moved 12 to 15 feet and by that time the bridge was wholly down.

Prof. GALBRAITH.—Where did you hear this loud noise?

Mr. LEFEBVRE.—It seemed to me to come from near the anchor pier. That is what it seemed to me.

Mr. ROY.—Perhaps you might indicate on the plan or a photo?

Prof. GALBRAITH.—We will take one of our own exhibits. Can you determine on the plan the main pier and the anchor pier? (Witness was shown plan marked Exhibit No. 25.) Witness points out on the plan the main pier, the anchor pier and the abutment.

Prof. GALBRAITH.—Point out where you were at the time of the accident. (Witness points out the place and it was marked with the letter 'C') adding 'I was opposite the derrick.'

Prof. GALBRAITH.—Can you indicate on the plan which is the Montreal side and which the Quebec side of the bridge? (Witness points it out correctly).

Prof. GALBRAITH.—What part of the bridge did you see during the accident?

Mr. LEFEBVRE.—I saw the portion of the bridge from about the third panel to the sixth panel or the seventh panel.

Prof. GALBRAITH.—Did you see anything particular or strange during the accident?

Mr. LEFEBVRE.—No, nothing.

Prof. GALBRAITH.—You were alone?

Mr. LEFEBVRE.—No, we were four or five—I think five—together.

Prof. GALBRAITH.—What did you and your fellows do after the accident?

Mr. LEFEBVRE.—We ran away towards the derricks. In doing so we turned our backs to the bridge.

Mr. HOLGATE.—Who was with you?

Mr. LEFEBVRE.—Four or five other men.

Mr. HOLGATE.—What were the names of the other men?

Mr. LEFEBVRE.—Johnson, Frank Proulx, Ferdinand, Roberge, a Russian whose name I do not know, and another Englishman or American whose name I do not know.

Witness adds that when he ran towards the derrick he immediately turned and ran towards the river to take a skiff that was there in order to render assistance to the people who had fallen into the river.

Mr. HOLGATE.—Had you any duties that would carry you on the structure itself?

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—Then, of your own knowledge, you know nothing about the condition of the bridge?

Mr. LEFEBVRE.—I heard things, but personally I do not know. I did not work on the bridge.

Mr. HOLGATE.—Can you give us positive information in regard to the bridge itself?

Mr. LEFEBVRE.—No, I am unable to.

Prof. GALBRAITH.—Did you see anything defective from below?

Mr. LEFEBVRE.—No, nothing at all.

Mr. HOLGATE.—Did you see any defect referred to in any conversation?

Mr. LEFEBVRE.—I saw nothing at all.

Witness discharged.

MICHAEL ESMOND, sworn.

Mr. HOLGATE.—What is your occupation?

Mr. ESMOND.—I was a boatman.

Mr. HOLGATE.—Where?

Mr. ESMOND.—I was fast to the bridge in case anything should fall over to pick it up.

Mr. HOLGATE.—How long had you been there?

Mr. ESMOND.—I had been there all last summer from the 3rd of July to November, 1906.

Mr. HOLGATE.—Always the same occupation?

Mr. ESMOND.—Yes.

Prof. GALBRAITH.—And this summer?

Mr. ESMOND.—I commenced on the 14th of May. Sometimes I used to be on the shore in what was called the bull gang.

Prof. GALBRAITH.—From May up till now?

Mr. ESMOND.—From May up till now.

Mr. HOLGATE.—Then, your duties never took you on the structure itself?

Mr. ESMOND.—No, sir.

Mr. HOLGATE.—Were you on duty the day of the accident?

Mr. ESMOND.—Yes, sir.

Mr. HOLGATE.—Have you got a clear recollection of what you noticed in consequence?

Mr. ESMOND.—Yes, of what I saw.

Mr. HOLGATE.—Where were you then at the time the accident happened?

Mr. ESMOND.—I was fast between the tenth and eleventh panel of the caisson.

Prof. KERRY.—You were tied to the bridge, Mr. Esmond?

Mr. ESMOND.—Yes, sir. between the tenth and eleventh panel. (Witness pointed out on plan marked Exhibit No. 25 the position he occupied at the time.)

Mr. HOLGATE.—You were outside of the bridge?

Mr. ESMOND.—Yes.

Prof. GALBRAITH.—Up stream or down stream?

Mr. ESMOND.—Down stream on the ebb tide.

Mr. HOLGATE.—Your position was that you were looking upwards at the bottom of the bridge?

Mr. ESMOND.—Yes, sir; my attention was all the time on the rising gang, the climbers, the men working outside.

Mr. HOLGATE.—Could you see the position of the big traveller from where you were?

Mr. ESMOND.—Yes, sir; the big traveller was a few feet inside of me. I was moved a little in case anything fell from the top.

Mr. HOLGATE.—Where was the big traveller?

Mr. ESMOND.—The big traveller was inside a little of the tenth panel—somewhere around the tenth panel.

Mr. HOLGATE.—Where was the other traveller?

Mr. ESMOND.—The other traveller was right on the outside putting on the iron.

Mr. HOLGATE.—At the extreme end of the bridge?

Mr. ESMOND.—Yes, sir. It had moved out. I do not know that I could specify the different pieces of iron by their names.

Mr. HOLGATE.—Was that the small traveller?

Mr. ESMOND.—The small traveller.

Mr. HOLGATE.—Was your attention called to the position of the locomotive?

Mr. ESMOND.—No, sir.

Mr. HOLGATE.—You do not know where it was?

Mr. ESMOND.—I do not know where it was. It seemed to me that it had run out. I know it had run out, but I did not follow it up. There are always little things falling from the work and I was away a little farther because I had to keep clear of anything that might fall, boards, or a hammer or anything. I suppose I was 100 feet below the bridge from the east side.

Mr. HOLGATE.—Did you observe anything unusual that day?

Mr. ESMOND.—No sir, nothing.

Mr. HOLGATE.—Everything was apparently the same as far as you observed as on the previous day?

Mr. ESMOND.—Yes, sir.

Mr. HOLGATE.—The operations on the bridge that you saw going on were the same as previously?

Mr. ESMOND.—To me they were all the same. Of course, I ran underneath it two or three times and I never dreamed that anything was going to happen. I could not believe my eyes when I saw it going because I would sit around it.

Mr. HOLGATE.—Then, when the accident happened, could you describe how the structure fell?

Mr. ESMOND.—I was looking up at the men—kind of looking upward and I thought I heard some sort of a noise at the shore. That took my attention and when I looked there I saw everything going. I saw, to the mest of my knowledge, the head of the big traveller.

Mr. HOLGATE.—Which way did the big traveller fall? Did it fall towards the end of the span, or did it fall to the east from the west?

Mr. ESMOND.—It seemed to me to be going straight direct out, because if it had come east it would have taken me sure. It would have come right near me, or even planks or anything on top of it would have come right down on me.

Prof. GALBRAITH.—Did the locomotive go over the end of the bridge?

Mr. ESMOND.—I could not say. I heard some rumbling ashore and it took my attention from above. I looked there and I saw everything going. It just went right out.

Mr. HOLGATE.—You said you heard a noise. Was it sufficient to attract your attention?

Mr. ESMOND.—I heard like a break or something inside of me—I could not say how far from the pier—but it took my attention, and then looking up I saw everything going.

Mr. HOLGATE.—What was the noise like?

Mr. ESMOND.—Like a clap of thunder.

Mr. HOLGATE.—It was a big heavy noise?

Mr. ESMOND.—A heavy noise.

Mr. HOLGATE.—You would not describe it as a sharp crack?

Mr. ESMOND.—I could not tell because I was a little excited at the time. I heard and saw everything going.

Mr. HOLGATE.—You gave it probably no consideration at all at the time?

Mr. ESMOND.—No, because after I heard some sort of rumbling ashore, some sort of a noise like thunder I looked and I saw everything going.

Prof. GALBRAITH.—Did the bridge fall straight or did it break up before it reached the water, or did it fall altogether?

Mr. ESMOND.—It seemed that it went all in a body.

Prof. GALBRAITH.—It did not seem that it broke up before it reached the water?

Mr. ESMOND.—No, sir.

Mr. HOLGATE.—You were what was known as a life saver?

Mr. ESMOND.—Yes, sir.

Mr. HOLGATE.—Kept as a precaution against accident?

Mr. ESMOND.—In case any one would fall over I was there to pick him up.

Prof. KERRY.—What did you do when you saw the bridge fall?

Mr. ESMOND.—I had an arrangement to myself. I had a small buoy that I used to put underneath the breast hook of the boat. I do not know if I got myself clear because when it struck the water it displaced a lot of water and it made an awful swell. It came right straight to me and I did not know where I was. I sat right down there and the boat headed for the east. The next wave was not as large and when it cleared up I heard men shouting for assistance and I went to get them out.

Mr. HOLGATE.—Your boat was attached to the bridge?

Mr. ESMOND.—Yes, I was attached to the bridge and I might have done it more by habit than by presence of mind. When I heard anything on the bridge I touched the buoy and I do not know whether I knocked myself clear or the sea shifted the position of the buoy.

Prof. GALBRAITH.—Do you mean that you were fastened to a buoy at the time of the accident?

Mr. ESMOND.—I was fastened to the bridge, there was a line from the bridge and at the end of the line I had a small buoy that I used to put into the boat under the breast hook of the boat and on the top of the thwart so that it was easy to let go.

Prof. KERRY.—You did not fasten the buoy; you just put it into the boat and it held?

Mr. ESMOND.—Yes, each boat has a breast hook and I had a piece of pulp-wood attached to the line and laid over the thwart just on top so that when I touched it it would clear. I do not know whether I did that or whether it worked out.

Witness discharged.

EUGENE LAJEUNESSE, sworn.

Mr. HOLGATE.—What is your occupation?

Mr. LAJEUNESSE.—Bridge work.

Mr. HOLGATE.—What do they call you on the pay roll? Are you an erector or riveter?

Mr. LAJEUNESSE.—I work at everything; general bridge workman.

Mr. HOLGATE.—Where are you employed? Were you employed on the Quebec bridge?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Who was your foreman?

Mr. LAJEUNESSE.—Meredith.

Mr. HOLGATE.—Are there any men here who were working with you?

Mr. LAJEUNESSE.—Yes, my brother.

Mr. HOLGATE.—Your brother and you were working together?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—At the time of this accident where were you working?

Mr. LAJEUNESSE.—We were on the deck.

Mr. HOLGATE.—Whereabouts; can you remember?

Mr. LAJEUNESSE.—Five panels out.

Mr. HOLGATE.—Near the anchor arm?

Mr. LAJEUNESSE.—No, on the floor beam.

Mr. HOLGATE.—On the anchor arm span or the cantilever? On the river span?

Mr. LAJEUNESSE.—Between the two piers in the centre.

Mr. HOLGATE.—Perhaps you can tell on this plan. (Witness pointed out the place on plan marked Exhibit No. 26).

Mr. HOLGATE.—Where were you at the time of the accident?

Mr. LAJEUNESSE.—I was right here—on the deck.

Mr. HOLGATE.—On the deck?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—At the main post between panels 4 and 5?

Mr. LAJEUNESSE.—Yes, sir.

Prof. GALBRAITH.—Which side of the bridge?

Mr. LAJEUNESSE.—West side of the bridge.

Mr. HOLGATE.—What were you doing there?

Mr. LAJEUNESSE.—I was doing nothing there at the time I was there. I was waiting for my brother to send me a box. We worked on the top.

Mr. HOLGATE.—Show us the point where you were working?

Mr. LAJEUNESSE.—We worked here ten minutes and there five minutes cleaning up everything.

Mr. HOLGATE.—Were you putting in bolts?

Mr. LAJEUNESSE.—We were finishing up the bolting.

Mr. HOLGATE.—Were those holes empty that you were bolting up?

Mr. LAJEUNESSE.—Yes; on the post.

Prof. GALBRAITH.—What pieces were joined by these holes?

Mr. LAJEUNESSE.—Two braces at the big post.

Prof. GALBRAITH.—Do you know the chord at that place? Do you know the piece called No. 5 chord?

Mr. LAJEUNESSE.—I know one chord is bent.

Prof. GALBRAITH.—I am not asking that. Do you know the chord in the 5th panel?

Mr. LAJEUNESSE.—No, I did not look at that.

Prof. GALBRAITH.—Have you worked on the 5th chord?

Mr. LAJEUNESSE.—No, on the posts only.

Mr. HOLGATE.—What knowledge have you that made you say just now that you saw a bent chord?

Mr. LAJEUNESSE.—That was on Monday I saw that. I worked there. I bolted up on that chord, it was bent.

Mr. HOLGATE.—Which chord was that? That is on the cantilever arm?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—That is out on the river?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—The second from the pier on the river side or the cantilever arm?

Mr. LAJEUNESSE.—Yes.

Prof. GALBRAITH.—No. 9 on the cantilever arm?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—You were at work at the time the accident happened to the bridge?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Have you any clear recollection of observing anything at the moment of the accident?

Mr. LAJEUNESSE.—No, I do not know anything about it. I made a jump and went down and I do not know anything about it. I jumped back when I saw everything going and then I fell down across a stringer, the stringer went down and I know nothing more.

Mr. HOLGATE.—What was the first notice you had of anything happening?

Mr. LAJEUNESSE.—It was nothing. I said 'I am finished'; that is all. I did not see anything.

Mr. HOLGATE.—You have told us about a chord member that you saw bent?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Did you see anything else ?

Mr. LAJEUNESSE.—That is all I saw.

Mr. HOLGATE.—How long had you been on the bridge ?

Mr. LAJEUNESSE.—Since about the 22nd of July.

Mr. HOLGATE.—Had you been pretty well over ?

Mr. LAJEUESSE.—Yes, I go everywhere on the bridge.

Mr. HOLGATE. Then that is the only thing you can speak positively about ?

Mr. LAJEUNESSE.—Yes, only that.

Mr. HOLGATE.—How was your attention called to it ?

Mr. LAJEUNESSE.—To the piece ?

Mr. HOLGATE.—Yes.

Mr. LAJEUNESSE.—I saw Mr. Yenser and Mr. Birks go there on Monday the 26th —Monday in the week of the accident.

Mr. HOLGATE.—Were you with them ?

Mr. LAJEUNESSE.—No, I worked right there. I was bolting on a strut there.

Mr. HOLGATE.—Did you know before that that this chord was bent ?

Mr. LAJEUNESSE.—No, I only saw it Monday.

Mr. HOLGATE.—When you saw Mr. Birks and Mr. Yenser there ?

Mr. LAJEUNESSE.—When we were coming from dinner we stopped—three or four of us and we looked. I saw Mr. Worley and he asked me what I was looking at. I said 'That bottom chord is bent.' Mr. Worley said : 'It is always like that'—and the whistle blew then.

Mr. HOLGATE.—Can you be sure about the location of the chord?

Mr. LAJEUNESSE.—Oh, sure.

Mr. HOLGATE.—It was on the river side ?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Of the pier?

Mr. LAJEUNESSE.—Yes, of the pier.

Mr. HOLGATE.—Out to the river?

Mr. LAJEUNESSE.—To the river, that is the one (pointing).

Prof. GALBRAITH.—And on the Quebec side?

Mr. LAJEUNESSE.—On the Quebec side it was then.

Mr. HOLGATE.—Now just describe that chord and what you saw there ?

The witness replied in French.

Mr. DAVIDSON.—He says it was plainly visible.

Mr. STUART.—It was bent towards the Quebec side and it was quite visible.

Prof. GALBRAITH.—Out from the centre line of the bridge ?

Mr. STUART.—Yes.

Mr. HOLGATE.—It was on the east side of the bridge and it was bent towards the east ?

Mr. STUART and Mr. DAVIDSON.—Towards the east.

Mr. HOLGATE.—How much was it bent, did you measure ?

Mr. LAJEUNESSE.—I did not measure, I saw it was two inches, it was bent all right because I went on the deck and looked down below and I would see.

Mr. HOLGATE.—Did you examine the chord.

Mr. LAJEUNESSE.—Yes, I was on the chord. When I came back to work I looked on the other side to see if it was bent and the other one looked all right.

Mr. HOLGATE.—That is on the Montreal side.

Mr. LAJEUNESSE.—Yes, the other I see is bent, I go to work that is all.

Prof. GALBRAITH.—Where did you see it from?

Mr. LAJEUNESSE.—From where I—rather from the strut.

Mr. HOLGATE.—Were you on the chord?

Mr. LAJEUNESSE.—Yes, only me there.

Mr. HOLGATE.—Yourself?

Mr. LAJEUNESSE.—I went on the chord to see if it was bent.

Mr. ROY.—Yes, he was there.

Mr. DAVIDSON.—He was working there?

Mr. STUART.—He was not working on it, he was working in the vicinity.

Mr. HOLGATE.—What was the condition of the lacing angles?

Mr. LAJEUNESSE.—I did not examine that, I saw only the chord bent, that is all.

Mr. HOLGATE.—There was no crack and no break, it was just a bend.

Mr. LAJEUNESSE.—On the pier?

Mr. HOLGATE.—On the chord?

Mr. LAJEUNESSE.—On no, it was only a bend, that is all.

Prof. GALBRAITH.—Were the four members of the chord bent?

Mr. LAJEUNESSE.—Oh, yes, if one were bent the others must be bent too.

Prof. GALBRAITH.—All in the same direction?

Mr. LAJEUNESSE.—All the same direction.

Prof. KERRY.—You were working on the posts?

Mr. LAJEUNESSE.—What?

Prof. KERRY.—You were working on the posts?

Mr. LAJEUNESSE.—At that time.

Prof. KERRY.—On the posts during the week?

Mr. LAJEUNESSE.—In the week, no, on the morning of that accident I was working on the front, we were reaming at that time.

Prof. KERRY.—When were you on the centre post the last time?

Mr. LAJEUNESSE.—On the centre post?

Mr. DAVIDSON.—For the last time?

Mr. LAJEUNESSE.—A week previous, the Saturday previous.

Prof. KERRY.—Were you at the bottom of it, in the shoe?

Mr. LAJEUNESSE.—Yes, I was at the bottom on the work there about 15 days back.

Prof. KERRY.—You heard them say that a plate was torn there?

Mr. LAJEUNESSE.—No, we did not see anything of that, we go all around and do not see anything.

Prof. KERRY.—It was all sound there?

Mr. LAJEUNESSE.—I guess so.

Prof. KERRY.—Everything was good?

Mr. LAJEUNESSE.—Yes, because we got some bolts there and we saw every place and we did not see that.

Prof. KERRY.—You saw the plate all right?

Mr. LAJEUNESSE.—I did not see that plate, we did not see anything bent or broken there, we did not see that.

Prof. KERRY.—But you have seen the plate yourself?

Mr. LAJEUNESSE.—It depends on which plate, there are several there. (Examining photograph.)

Mr. HOLGATE.—(Pointing to photograph). Was one of these plates crooked?

Mr. LAJEUNESSE.—I do not think so.

Mr. HOLGATE.—If there was a crack is it likely you would see it from where you were?

Mr. LAJEUNESSE.—If there was something there I would see it all right because we worked right there.

Mr. HOLGATE.—Did I understand that the plate was crimped but there was no crack in it?

Mr. LAJEUNESSE.—I saw the crimp in the plate, but there was no crack in the plate.

Mr. HOLGATE.—Have you seen the crimp?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—You have seen it?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—But not a crack?
Mr. LAJEUNESSE.—Oh, no.
Prof. KERRY.—You worked there a fortnight?
Mr. LAJEUNESSE.—Yes, I worked there a fortnight, my brother and myself.
Prof. KERRY.—Have you sat on the plate?
Mr. LAJEUNESSE.—Oh, yes.
Mr. HOLGATE.—Who was with you?
Mr. LAJEUNESSE.—My brother.
Mr. HOLGATE.—At the time that you saw this plate?
Mr. LAJEUNESSE.—My brother.
Mr. HOLGATE.—He was with you then?
Mr. LAJEUNESSE.—Oh, yes, we worked all the time, me and him.
Mr. HOLGATE.—Was there anybody else?
Mr. LAJEUNESSE.—Oh, no, only me and him.
Mr. HOLGATE.—Just the two of you?
Mr. LAJEUNESSE.—Oh, yes.

Witness discharged.

The Commission adjourned until 10 o'clock to-morrow (Friday) morning.

FIFTH DAY.

FRIDAY, September 13, 1907.

The Commission resumed at 10 o'clock this morning.

JAMES JOHNSON, sworn.

Mr. HOLGATE.—Are you an employee of the Phœnix Bridge?
Mr. JOHNSON.—Yes, sir.
Mr. HOLGATE.—Were you at work on August 29?
Mr. JOHNSON.—I was.
Mr. HOLGATE.—Where were you working?
Mr. JOHNSON.—I was working under the bridge down in the yard, what is known as the yard in the bridge.
Mr. HOLGATE.—In what capacity were you working there?
Mr. JOHNSON.—I had charge of the bull gang, that is the gang of labourers handling the iron.
Mr. HOLGATE.—On the ground?
Mr. JOHNSON.—On the ground.
Mr. HOLGATE.—Did your work take you on to the structure at all?
Mr. JOHNSON.—Yes, sir.
Mr. HOLGATE.—In what way?
Mr. JOHNSON.—Well, in different ways. I had different work under there, laying iron under there, pulling out the foundation out of the foundation hole.
Mr. HOLGATE.—But did your work take you on to the structure, on to the bridge?
Mr. JOHNSON.—No, I was very seldom on to the bridge.
Mr. HOLGATE.—Did you ever have to go on to the bridge in connection with your work, or was it just curiosity?
Mr. JOHNSON.—I went on to the bridge to see the foreman, and things like that; yes, but I did not have to take my gang on to the bridge at all.

Mr. HOLGATE.—It has been proved already that there was an accident upon August 29 at the bridge, did you witness that?

Mr. JOHNSON.—Oh, yes, I saw a part of it.

Mr. HOLGATE.—Where were you when that took place?

Mr. JOHNSON.—I was back there, about there.

Mr. HOLGATE.—Could you indicate on plan 26?

Mr. JOHNSON.—I was back there on the second panel on the second point, this point about here on the west side about 10 or 15 feet from the edge of the bridge; I was not right under it.

Mr. HOLGATE.—You were on the ground?

Mr. JOHNSON.—Yes.

Mr. HOLGATE.—Below that panel?

Mr. JOHNSON.—Yes.

Mr. HOLGATE.—East or west of the bridge?

Mr. JOHNSON.—West.

Mr. HOLGATE.—Ten or fifteen feet away?

Mr. JOHNSON.—Maybe fifteen, I never measured it.

Mr. HOLGATE.—West of the bridge, underneath the second panel point of the anchor span.

Mr. JOHNSON.—That is correct.

Prof. GALBRAITH.—Were you with Jos. Lefebvre?

Mr. JOHNSON.—He was working with me, the same place I was.

Prof. KERRY.—What did you actually see?

Mr. JOHNSON.—What did I see?

Prof. KERRY.—Yes.

Mr. JOHNSON.—Well, my way of seeing it, I heard the locomotive run out on it; I will tell you as near as I can what I think I saw and heard.

Prof. GALBRAITH.—Where was the locomotive?

Mr. JOHNSON.—I did not see it, I heard it running out and I heard a racket and it seemed to me like a piece of iron falling off the car or a car jumped off the track. Then I looked up and and I looked back about the third panel maybe from the pier, on the anchor span. It looked to me what I saw as if the stringers were parting. It may have been a chord or something else that I saw.

Prof. GALBRAITH.—Did you turn around when you heard the noise?

Mr. JOHNSON.—I looked up like that (indicating). I had a track gauge in my hand. I seen it coming, the next thing I done, I started to run.

Prof. GALBRAITH.—You were looking towards the main pier at that time, to the work above the main pier?

Mr. JOHNSON.—Yes, I looked up towards the main pier.

Mr. HOLGATE.—From where you stood were the two stringers distinctly visible?

Mr. JOHNSON.—They were, yes, but in looking quick like that, I just took a glance at it, I did not stop to see how it was coming or anything else, I started to run. It looked to me like the stringers had parted, like that (indicating) and was falling endwise. It looked like the stringers, it may have been trusses or chords or anything else.

Mr. HOLGATE.—That is what I meant, we can easily understand that you were not looking for anything particular at that moment, but did anything impress itself at that moment on your mind distinctly?

Mr. JOHNSON.—The impressible thing was getting out of the road about that time, I could not say anything else.

Prof. KERRY.—That was just the one movement that attracted your attention, the apparent falling of the stringers?

Mr. JOHNSON.—Yes, and then I glanced back and I see the whole thing wave, kind of rock.

Prof. KERRY.—Go ahead in your own way.

Mr. JOHNSON.—Well, I started to run. I ran out probably 30 or 40 feet and I looked again and the only thing I could see was a cloud of smoke, it was all hidden in a cloud of smoke and over the smoke I could see the wooden false work on the pier, I saw it fall back.

Prof. KERRY.—In which direction did it fall?

Mr. JOHNSON.—Back towards the shore. There was such a cloud of smoke I could just see the wooden false work standing on the pier.

Prof. KERRY.—Standing on the main pier?

Mr. JOHNSON.—Yes.

Prof. KERRY.—You saw that fall back?

Mr. JOHNSON.—Yes.

Prof. KERRY.—It fell back towards the shore?

Mr. JOHNSON.—Fell back towards the shore, yes.

Mr. HOLGATE.—Are you in a position to remember and say what part of the structure first reached the ground?

Mr. JOHNSON.—I could not say the way; I saw it start; it looked like it started where I saw those stringers fall, but I did not wait to see what part hit the ground.

Mr. HOLGATE.—That point was where?

Mr. JOHNSON.—I could not be sure about that because I looked so quick but it was in about the third point back from the pier.

Prof. KERRY.—At that point, Mr. Johnson, the stringers, if I remember right, are very considerably above the chord?

Mr. JOHNSON.—Yes.

Prof. KERRY.—So that there should not have been any confusion in your mind between the chord and the stringer?

Mr. JOHNSON.—Well I would not be sure about that now, I would not be sure about just what I did see because it happened so quick. I just took one glance at it, and I was going.

Prof. KERRY.—But at that point the chord is curving down very fast?

Mr. JOHNSON.—Yes.

Prof. KERRY.—The stringer is quite high?

Mr. JOHNSON.—The stringer is away above the chord, yes.

Prof. KERRY.—Do you remember whether among your bull gang there, Mr. Johnson, there was any one who got a really good view of the accident?

Mr. JOHNSON.—No, I do not know anyone who told me. They all were busy running, I guess, about that time.

Prof. KERRY.—They were all close under the spot?

Mr. JOHNSON.—They were all with me except one of my men, a boy, and he was killed.

Prof. GALBRAITH.—Was he under the wreck?

Mr. JOHNSON.—He was under the wreck, I had him working under there, working on some pins.

Prof. GALBRAITH.—Had any of your gang previously been working on the bridge?

Mr. JOHNSON.—Well, I do not think so.

Prof. GALBRAITH.—Or yourself?

Mr. JOHNSON.—I do not think any of them were.

Prof. GALBRAITH.—You know nothing personally about the condition of the bridge before the wreck?

Mr. JOHNSON.—No, I do not know anything about it whatever, I think it is the same as it always was.

Mr. HOLGATE.—What was the last occasion you were on the bridge, previous to this wreck?

Mr. JOHNSON.—The last occasion the morning it went down, probably about 8 o'clock.

Mr. HOLGATE.—Did you traverse the whole bridge?

Mr. JOHNSON.—Yes, clear out to the end of it, I went out to see the foreman.

Mr. HOLGATE.—Did you notice anything in your own mind that day at any particular point?

Mr. JOHNSON.—No, I saw nothing on the bridge, nothing different from what it always was, but I did not look at it, I just walked out the track, I did not pay any attention to the bridge.

Mr. HOLGATE.—I understand your duties were not of a special character on the structure, so that you made no examination yourself?

Mr. JOHNSON.—No.

Mr. HOLGATE.—So that really I understand you can give us no information in that direction?

Mr. JOHNSON.—In regard to the condition of the bridge?

Mr. HOLGATE.—From your personal knowledge?

Mr. JOHNSON.—None whatever.

Witness discharged.

INGWALL HALL, sworn.

Mr. HOLGATE.—Are you an employee of the Phœnix Bridge Company, Mr. Hall?

Mr. HALL.—Yes.

Mr. HOLGATE.—What are your duties?

Mr. HALL.—Well, whatever I am required to do as a bridge man or structural iron worker.

Mr. HOLGATE.—How are you classified on the pay roll, are you classified as an erector?

Mr. HALL.—Well, I do not know really what you mean by the word 'erector.'

Mr. STUART.—He is classified as an erector.

Mr. HOLGATE.—How long have you been in the service of the Phœnix Bridge Company on this particular work?

Mr. HALL.—Since July 5.

Mr. HOLGATE.—Since July 5, 1907?

Mr. HALL.—Yes.

Mr. HOLGATE.—Were you working on August 29?

Mr. HALL.—Yes, sir, I was working that day.

Mr. HOLGATE.—Where were you working?

Mr. HALL.—I was working on top of the traveller.

Mr. HOLGATE.—Where was the traveller?

Mr. HALL.—It was right about here (indicating on Exhibit 26).

Mr. HOLGATE.—Which traveller was that?

Mr. HALL.—The big traveller. The traveller was sitting at the end of the cantilever. Of course they had not got any further, just about here (indicating). Of course they had to leave the big traveller there to lift the little traveller over here.

Mr. HOLGATE.—The big traveller then was located on panel No. 1 of the cantilever arm?

Mr. HALL.—Yes, between 1 and 2, I cannot tell positively sure, I did not take enough notice.

Mr. HOLGATE.—But to the best of your knowledge that is where it was located?

Mr. HALL.—Panel No. 1, cantilever arm, that is as far as it went ahead.

Prof. GALBRAITH.—The front of the traveller was about the middle of panel No. 1.

Mr. HOLGATE.—There was another traveller on the bridge?

Mr. HALL.—Yes.

Mr. HOLGATE.—How was that other traveller known, what was it called?

Mr. HALL.—It is a small traveller, the small traveller we say is the cantilever traveller.

Mr. HOLGATE.—Can you say where that was at the same time?

Mr. HALL.—Well I would not say now if it was the fourth or fifth panel it was sitting on. It was sitting on the fourth panel ready to raise the fifth panel.

Mr. HOLGATE.—On the fourth panel of what you call the suspended span?

Mr. HALL.—Of the centre span, yes.

Mr. HOLGATE.—Of the centre span, the suspended span.

Mr. STUART.—I think that is not quite accurate, it was on the third ready to raise the fourth, that is what Mr. Milliken tells me.

Mr. HALL.—I would not be sure about that because I was not working that morning.

Mr. HOLGATE.—It was there anyway, you are not quite sure whether on the third or fourth panel?

Mr. HALL.—No.

Mr. HOLGATE.—And Mr. Millikin would know definitely about that?

Mr. HALL.—Yes.

Mr. HOLGATE.—Now, at the time of the accident, where was the locomotive?

Mr. HALL.—I could not tell, I did not notice it.

Mr. HOLGATE.—You cannot locate the locomotive?

Mr. HALL.—No, I cannot locate the locomotive.

Mr. HOLGATE.—Do you remember it was on the bridge at all?

Mr. HALL.—To tell the truth I do not remember it was on the bridge at all, because I did not notice it.

Mr. HOLGATE.—What was the big traveller doing at the time of the accident?

Mr. HALL.—Well one of the booms on the Montreal side was hoisting up a couple of timbers, had hoisted them up and was just landing two timbers.

Prof. GALBRAITH.—Big timbers?

Mr. HALL.—Yes, it was getting ready to move the derricks down on the boat like. They call it the boat, right under the top girders, and it was just landed.

Mr. HOLGATE.—At the time of the accident?

Mr. HALL.—At the time of the accident, yes.

Mr. HOLGATE.—Where were you on the traveller at the time of the accident?

Mr. HALL.—I was on the Quebec side, on the boat, what we call the boat of the traveller.

Prof. GALBRAITH.—On the big traveller?

Mr. HALL.—Yes, right below the top girders.

Prof. KERRY.—The traveller was actually being taken down on that day?

Mr. HALL.—Yes, sir.

Mr. HOLGATE.—Was it being dismantled, do you mean?

Mr. HALL.—Well we took some sheave boxes and some pins and a couple of boat loads of bolts were lowered down.

Prof. KERRY.—Had you just commenced taking it down?

Mr. HALL.—No, we started Friday morning.

Prof. KERRY.—You started on Friday morning to take down the traveller?

Mr. HALL.—To take down the sheave boxes. Well there was part of the traveller taken down before, the outrigger of the traveller, that was all taken off.

Prof. GALBRAITH.—When was that taken off?

Mr. HALL.—Oh, two weeks before that we had been working on it.

Prof. GALBRAITH.—In the two weeks before?

Mr. HALL.—Yes.

Prof. GALBRAITH.—And only the main floor of the traveller was standing?

Mr. HALL.—Only the main floor of the traveller was standing, yes, and two heavy girders on top to amount to anything of real heft on the traveller.

Prof. GALBRAITH.—What did they belong to?

Mr. HALL.—They belonged to strengthen the traveller on top.

Mr. HOLGATE.—As this material was taken down, that is material belonging to the traveller, was it left on the bridge close to the traveller?

Mr. HALL.—It was left down below on the bars on the top bars of the bridge; that is for a few days, then it was rigged up and we took them off there and lowered them down to the water on a flat boat and they were taken away to the other side.

Prof. GALBRAITH.—What was the main traveller resting on, the top or bottom of the bridge?

Mr. HALL.—It was resting on the bottom, the bottom chords.

Prof. KERRY.—Were the hoisting engines taken down?

Mr. HALL.—There never was an engine on top of the traveller, they were below.

Prof. KERRY.—They were on the floor, were they?

Mr. HALL.—They were on the floor.

Prof. KERRY.—What did you notice first when the accident happened, Mr. Hall?

Mr. HALL.—Well in the position I was I could not look back on the bridge very far because I had a big girder right in front of me and there was only a space of three feet before the eyes there so I could not see very much. I mean to say I could not mention anything just as she started to go down.

Prof. GALBRAITH.—What part of the traveller were you on?

Mr. HALL.—On the Quebec side.

Prof. GALBRAITH.—No, I mean how high up on the traveller?

Mr. HALL.—I did not measure it myself but I heard it is about 400 feet from the water.

Prof. GALBRAITH.—What part of the traveller were you on, the upper part?

Mr. HALL.—I was ten feet below the top.

Prof. GALBRAITH.—And near the front or near the back?

Mr. HALL.—Near the front.

Prof. KERRY.—You knew there was something wrong just by feel and not by sight?

Mr. HALL.—Well I could feel it start to go down and it was going down fast you got tears in your eyes, and you could hardly realize anything beside you. My partner was just about 7 or 8 feet from me, and I never noticed him and never saw him—never knew anything.

Prof. GALBRAITH.—How did it go at first?

Mr. HALL.—At first it did not make an awful noise when it started.

Prof. GALBRAITH.—Did it go slowly or fast?

Mr. HALL.—No, it went kind of fast at the start till it struck the deck of the bridge, then it seemed to me it kind of slowed up a little bit.

Prof. GALBRAITH.—How do you mean till it struck the deck?

Mr. HALL.—Till it struck the deck, till the deck struck the water, then it seemed to slow up.

Prof. GALBRAITH.—After it struck the water?

Mr. HALL.—After it struck the water, that is it slowed up gradually like, it did not go as fast as before.

Prof. KERRY.—You went down on the traveller all the time?

Mr. HALL.—Yes, I was staying there all the time, that same position.

Prof. GALBRAITH.—The traveller did not upset?

Mr. HALL.—No, the traveller stayed right there. It was fastened to the top chords a few days before, it was fastened for safety to keep the traveller steady to lower the girders, and that helped a good deal to hold it in place.

Prof. GALBRAITH.—It was the full width of the bridge?

Mr. HALL.—Yes, it was extended out 20 feet on each side of the bridge.

Prof. GALBRAITH.—Did you lose consciousness?

Mr. HALL.—No, sir, I did not.

Prof. GALBRAITH.—You were conscious until you came to the top of the water afterwards?

Mr. HALL.—Well, yes, I was.

Prof. GALBRAITH.—When you came to the top of the water was everything out of sight in that neighbourhood?

Mr. HALL.—Everything was out of sight except timbers, and I do not know how many voices were hollering for help, that is all.

Prof. GALBRAITH.—Around you?

Mr. HALL.—Around me, yes. The water was too unruly for me to notice how many.

Prof. GALBRAITH.—That is rough?

Mr. HALL.—Yes, it seemed as though it was going fore and back in small waves so you would have to hoist yourself up to the chest to breathe without drinking water.

Prof. GALBRAITH.—Where were you injured?

Mr. HALL.—I got two fingers taken off, and the third the flesh taken off.

Prof. GALBRAITH.—You were able to swim?

Mr. HALL.—Yes, I was able to swim.

Mr. HOLGATE.—Do you remember which way you were facing when this took place?

Mr. HALL.—I was facing towards the shore.

Mr. HOLGATE.—The south shore?

Mr. HALL.—Yes, towards the pier, from the water towards the pier.

Prof. GALBRAITH.—Have you any recollection of how the bridge went down? Did it go down in one piece or not, the cantilever end?

Mr. HALL.—Well I would not positively say, but it was nothing that broke close by where the traveller was because it was going down too steady for that. It seemed just like it was tipping on an axle like, on the pier; that is the way it seemed to me.

Mr. HOLGATE.—That clearly represents your idea?

Mr. HALL.—Yes, sir.

Mr. HOLGATE.—Were you in any way generally familiar with the whole bridge? Your duties on the traveller, were they continuous, were you always working on the traveller?

Mr. HALL.—No, I was driving rivets for a while.

Mr. HOLGATE.—How long had you been working on the traveller prior to this accident?

Mr. HALL.—I should judge about a month.

Mr. HOLGATE.—In doing that you would have to traverse the bridge in the morning; how did you get to the traveller?

Mr. HALL.—To the traveller?

Mr. HOLGATE.—Yes, did you walk out to the traveller?

Mr. HALL.—Yes, I walked out and walked up the angles.

Mr. HOLGATE.—And then you would go back at dinner time?

Mr. HALL.—Back at dinner time.

Mr. HOLGATE.—And out at 1 o'clock?

Mr. HALL.—Out at 12.45.

Mr. HOLGATE.—And return to the shore at six?

Mr. HALL.—At six.

Mr. HOLGATE.—So when working on the traveller you went over that bridge four times a day?

Mr. HALL.—Yes.

Mr. HOLGATE.—Did you ever notice anything particular in the condition of the bridge on those trips, anything that called your attention especially to——

Mr. HALL.—No, not that I saw myself, but I heard some talk about what had been brought up about that bottom chord. There was quite a few the night before went down and looked up there and they said: That is kinking in from the heft of the wind.

Mr. HOLGATE.—Do you know what bottom chord they were talking about?

Mr. HALL.—On the Montreal side, I do not know what position it was in really.

Mr. HOLGATE.—And you know nothing of your own knowledge?

Mr. HALL.—No, I did not see it.

Mr. HOLGATE.—You did not see it ?

Mr. HALL.—No, I was just taking the word of my room mate, Harry Briggs, who got lost.

Mr. HOLGATE.—Are any of those men to whom you refer at present working for the company, are they survivors ?

Mr. HALL.—Why there is one with me over in the hospital in Levis; he is known as Alexander Beauvais.

Mr. HOLGATE.—Anybody else ?

Mr. HALL.—No, I guess all the rest are dead.

Mr. HOLGATE.—So that whatever information you got was from Beauvais ?

Mr. HALL.—Yes, he told me about his work, where he was working. He was riveting on the first point.

Mr. HOLGATE.—All I want to know is that is your source of information and your only source of information ?

Mr. HALL.—Yes.

Mr. HOLGATE.—And you know nothing of it personally?

Mr. HALL.—No.

Mr. HOLGATE.—And is that the only point that was brought to your attention?

Mr. HALL.—Well, yes.

Prof. GALBRAITH.—Did you ever notice any unusual springing up and down on the bridge while you were on the traveller ?

Mr. HALL.—The last half day, the last few hours, I might say, it was awful springy, and of course we had some iron lowered on the bridge which was laying on the deck of the bridge and they were using the boom from the traveller that I was on to hoist it up from the bridge and laid it on flat cars, and every time they dropped on the cars why it seemed as though it would spring down about a foot under you.

Prof. GALBRAITH.—How much of a drop was there from the fall to the flat car?

Mr. HALL.—Well, it would not be more than may be a foot or so.

Prof. GALBRAITH.—What kind of pieces were being loaded ?

Mr. HALL.—Oh they were the sheave boxes.

Prof. GALBRAITH.—This was for the traveller ?

Mr. HALL.—For the traveller.

Prof. GALBRAITH.—Was any part of the bridge being loaded by the traveller at that time ?

Mr. HALL.—No, sir.

Prof. GALBRAITH.—How far up and down would you estimate the spring owing to this loading?

Mr. HALL.—Well, I could not mention exactly.

Prof. GALBRAITH.—I want to know whether it was an inch or a foot ?

Mr. HALL.—No. It could not go down a foot because if it did we would not come up.

Prof. GALBRAITH.—I want your idea exactly.

Mr. HALL.—Well it would jar enough so you would notice it good and plain and you would feel afraid; you would feel the shock every time they dropped anything.

Prof. GALBRAITH.—Did you notice while you were on this traveller, any side motion, as well as the up and down motion ?

Mr. HALL.—No.

Prof. GALBRAITH.—Do you know that the motion was up and down?

Mr. HALL.—Yes.

Prof. GALBRAITH.—You could tell that ?

Mr. HALL.—Yes, that is the way it felt for us up there.

Prof. GALBRAITH.—This occurred how long before the accident ?

Mr. HALL.—Oh this was about within an hour or two hours before the accident happened.

Prof. GALBRAITH.—Have you noticed that swinging or a similar swinging any time before that ?

Mr. HALL—No, sir, not as bad, hardly any at all.

Prof. GALBRAITH.—You always felt the traveller safe until the time you speak of, a short time before the acident ?

Mr. HALL.—Yes, while it felt shaky—of course this was light iron, I do not think these little pieces were half a ton even.

Prof. GALBRAITH.—That you refer to ?

Mr. HALL.—Yes, that were loaded on the cars.

Prof. GALBRAITH.—At the time?

Mr. HALL.—Yes, it was not half a ton heft, no, it was not a quarter of a ton you might say.

Prof. GALBRAITH.—You had work on the traveller when the cranes extended outwards towards the end of the bridge were on, and when heavy pieces of iron were being unloaded from the cars on to the bridge ?

Mr. HALL.—Yes.

Prof. GALBRAITH.—And did you notice any motion of the traveller that felt unsafe up to that time ?

Mr. HALL.—No, sir.

Mr. HOLGATE.—Do you recollect that the engine was out far on the bridge that same day during the morning or at any time with some carloads of material ?

Mr. HALL.—No, not any further than the traveller.

Mr. HOLGATE.—It was up as far as the traveller?

Mr. HALL.—Up as far as the traveller, yes.

Mr. HOLGATE.—And had the engine ever been any further than that before?

Mr. HALL.—That is something I could not answer because I do not recollect.

Mr. HOLGATE.—Do you recollect what that engine was taking out there, how many cars it had with it?

Mr. HALL.—It generally had two cars.

Mr. HOLGATE.—On this occasion were they loaded?

Mr. HALL.—No, empty.

Mr. HOLGATE.—I am speaking now of the morning of the same day?

Mr. HALL.—Well, I did not notice whether they had any cars or engines out there in the forenoon, or the afternoon really, but as I say the engine was out as far as the traveller, but whether it went any further that day I do not know, that is I cannot recollect seeing it or noticing it.

Mr. HOLGATE.—When the engine was out there at any time during that day did you notice that vibration in the bridge up and down?

Mr. HALL.—No.

Mr. HOLGATE.—So that the only time you noitced it was a short time before?

Mr. HALL.—When I was loosening the lines on the traveller I was working on.

Mr. HOLGATE.—And at that time the engine was not on the bridge?

Mr. HALL.—That is, not in my memory, what I seen.

Mr. HOLGATE.—Well, now, who else is there that could give us information clearly on that point?

Mr. HALL.—Oscar Lebarge. He is laid up. He has got a fractured jaw and an injured leg.

Prof. GALBRAITH.—Did you notice the behaviour of the centre posts at any time during the fall?

Mr. HALL.—Everything seemed good and solid to me—no failure that I noticed.

Prof. GALBRAITH.—I mean during the accident.

Mr. HALL.—During the accident?

Prof. GALBRAITH.—You could not say?

Mr. HALL.—I could not say.

Prof. GALBRAITH.—You could not see the beginning of the fracture of the main posts?

Mr. HALL.—No, sir.

Witness discharged.

Mr. D. B. HALEY, sworn.

Mr. HOLGATE.—Are you an employee of the Phœnix Bridge Company?

Mr. HALEY.—Not at present; I was discharged. I was, though.

Mr. HOLGATE.—When did you enter their service in connection with the work at the Quebec bridge?

Mr. HALEY.—On June 18.

Mr. HOLGATE.—1907?

Mr. HALEY.—June 19. I came here on June 18, and went to work on June 19, 1907.

Mr. HOLGATE.—In what capacity were you working?

Mr. HALEY.—As an all-round bridge man.

Mr. HOLGATE.—When did you leave the service of the company?

Mr. HALEY.—I was discharged.

Mr. HOLGATE—When were you discharged?

Mr. HALEY.—After this accident.

Mr. HOLGATE.—That was when?

Mr. HALEY.—August 29.

Mr. HOLGATE.—You have not worked since?

Mr. HALEY.—No.

Mr. HOLGATE.—But you were in their employ on August 29?

Mr. HALEY.—Yes.

Mr. HOLGATE.—Where were you working on August 29?

Mr. HALEY.—On the top chord traveller, where I always worked.

Mr. HOLGATE.—Where was it at that time?

Mr. HALEY.—(Referring to plan marked Exhibit No. 26.) It was right up here. The jib was overhanging out here and I was on the extreme end of the jib.

Mr. HOLGATE.—Just indicate where you were.

Mr. HALEY.—It was the fourth panel. We were standing near the third panel and I was out over the fourth panel. The jib rests over this and I was out on the end of it.

Prof. GALBRAITH.—What did that panel rest on?

Mr. HALEY.—On the upper chord of panel No. 3.

Mr. HOLGATE.—When the accident happened what was being done on that traveller, and where were you?

Mr. HALEY.—I was on the extreme end of it. I had been doing some rigging out there. There was not much of anything being done, we were waiting for iron to come out, there was a little lull for half an hour and I was doing a little job that I had been waiting for a slack time to do.

Mr. HOLGATE.—You say that you had continuously worked on this traveller?

Mr. HALEY.—I was signal man and any time there was anything to do I was kept there busy. Then it was slack and I was out there doing a little job on the rigging.

Mr. HOLGATE.—Since the time that you went there on June 19, you worked continuously?

Mr. HALL.—Yes, sir.

Mr. HOLGATE.—Every day that the weather would permit?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—And always on that traveller?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—When the accident happened have you any clear recollection of what did happen?

Mr. HALEY.—Yes, sir, I have a very clear recollection of what did happen.

Mr. HOLGATE.—Just, shortly, in your own words, tell us what you saw.

Mr. HALEY.—I was on the extreme end of it and the first thing I knew I caught myself going through the air. I realized that the iron fell very much faster than I did and left me falling through the air. The next thing I remember I was deep in

water. In a short time I came up—I swam up—some planks came up around me, I got on the planks and was rescued by a boat on the other side of the river twenty minutes or so afterwards, or as soon as they could get over.

Mr. HOLGATE.—Had you a view of the structure behind you, as it was falling?

Mr. HALEY.—No sir, none whatever and heard no noise. I was in the water before the noise came.

Prof. GALBRAITH.—You were fully conscious during the whole of the time until you came to the top of the water?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—You hung on to this jib as you were falling?

Mr. HALEY.—I hung on to nothing. What I was sitting on fell away from me and I fell through space. The only thing I hung on to was the plank that I got hold of when I came up.

Prof. GALBRAITH.—Do you know whether the jib fell faster than you fell; or whether you passed it?

Mr. HALEY.—The jib fell faster than I did. I remember that all right.

Mr. HOLGATE.—From what you know was it the whole general structure or something of any local nature where you were working that fell? Did the whole structure fall as one or are you in a position to say anything at all about that?

Mr. HALEY.—The way it appeared to me was that it broke off and let that part go down and the way I accounted for not hearing any noise was that the anchor arm fell afterwards, after the balance had gone.

Prof. GALBRAITH.—What do you mean by saying that part falling off?

Mr. HALEY.—I mean the whole cantilever arm.

Mr. HOLGATE.—Did your duties take you to any other part of the bridge?

Mr. HALEY.—No, sir.

Mr. HOLGATE.—But you passed over the bridge, probably, four times a day?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—In passing over have you, at any time, noticed anything extraordinary?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—Was your attention called to it or did somebody draw it to your notice?

Mr. HALEY.—My attention was called to it by somebody, and then I went down and looked at it.

Mr. HOLGATE.—Who called your attention to it?

Mr. HALEY.—My partner, Mr. Cook, who is now dead.

Mr. HOLGATE.—When your attention was called to this particular thing you examined it?

Mr. HALEY.—Yes, sir. We decided that right when the whistle blew that night we would go down and look at it. That was on August 28.

Mr. HOLGATE.—Was there only one point or more than one point?

Mr. HALEY.—Our attention was called to one point and we examined several points and found several points defective, too.

Mr. HOLGATE.—Beginning with the point that Mr. Cook pointed out to you can you designate accurately what that was?

Mr. HALEY.—Yes.

Mr. HOLGATE.—Can you show it on this plan? (Referring to plan marked Exhibit No. 26.)

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—How do you know these parts—by their erection numbers?

Mr. HALEY.—I am not very well acquainted with the erection numbers. I had nothing to do with the erection numbers. I only did as I was told. I know the names of the different sections.

Mr. HOLGATE.—Just indicate on this plan. (The witness indicated the splice marked No. 9 on the Quebec side of the cantilever arm of the lower chord).

Mr. HOLGATE.—Is that it ?

Mr. HALEY.—Yes, sir, that is what my attention was called to.

Mr. HOLGATE.—Did you examine it ?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—What did you find ?

Mr. HALEY.—I found that it was bulging out on both sides.

Mr. HOLGATE.—The splice was ?

Mr. HALEY.—Near the splice and the splice itself as well.

Prof. GALBRAITH.—Which chord ?

Mr. HALEY.—On the Quebec side.

Prof. GALBRAITH.—You say it was bulging out ? Is that the splice ? What was bulging out ?

Mr. HALEY.—This chord.

Prof. GALBRAITH.—That is the chord of panel 8 ?

Mr. HALEY.—Yes.

Prof. KERRY.—What was bulging actually ? What part of the splice ?

Mr. HALEY.—All the webs and the chord. There were four webs and this chord, two outside ones and two centre ones and they were all giving way. The two outside ones were going out.

Prof. GALBRAITH.—From the centre of the bridge ?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—Then you say that all four webs were bending towards Quebec ?

Mr. HALEY.—No, the inside web was bending towards Montreal and the outside web bending towards Quebec, showing that there was too much compression put on and it would not stand the strain and it was giving.

Prof. KERRY.—And the centre webs were comparatively slight, were they ?

Mr. HALEY.—No, they were not. They showed the wobble.

Prof. KERRY.—The centre webs were twisted like that (indicating) ?

Mr. HALEY.—Exactly.

Mr. HOLGATE.—I do not think that is what he said.

Prof. KERRY.—We understand that the web on the Quebec side was bent out towards Quebec ?

Mr. HALEY.—That is what I said.

Prof. KERRY.—The web on the Montreal side was bent out towards Montreal ?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—And the two centre webs were bent into a very long S shape ?

Mr. HALEY.—Yes, as close as you can get at it.

Prof. KERRY.—What did the lacing show ?

Mr. HALEY.—It was bent down in one space and up in another space. Some of it showed a bend sideways and kinked.

Prof KERRY.—The lacing was bent in different ways ?

Mr. HALEY.—Yes, sir, in between the rivets. Across from one web to the other one lacing would be bent down and the next bent up and several of these showed a bend.

Prof. GALBRAITH.—What distance along this chord No. 8 did you see the lacing in that shape ?

Mr. HALEY.—At that particular point, about four feet.

Prof. GALBRAITH.—That would cover this whole panel of lacing—about one square of lacing ?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—You did not see any other squares of lacing which were bent ?

Mr. HALEY.—Not at that point.

Mr. HOLGATE.—This examination was made at what hour and on what day ?

Mr. HALEY.—A quarter past six on August 28.

Prof. GALBRAITH.—You are speaking of the lacing on chord 8 ?

Mr. HALEY.—Yes, sir.

Mr. GALBRAITH.—Next to the cover plate and the joint ?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—Did you make an inspection of it afterwards ? Did you see it again ?

Mr. HALEY.—No, I never saw it any more.

Prof. KERRY.—When did Mr. Cook see it first ?

Mr. HALEY.—Mr. Cook saw it the same time I did.

Prof. KERRY.—Did he mention it to you ? He had seen it previously ?

Mr. HALEY.—He had been told about it previously.

Prof. KERRY.—Who told him ?

Mr. HALEY.—Mr. Britton.

Prof. KERRY.—Is he alive still ?

Mr. DAVIDSON.—Yes, he is here.

Prof. KERRY.—You say that the webs of the chords were bent close to the cover plate on the 8th chord and you also say that there was a bend at the joint. What was there at the joint ?

Mr. HALEY.—The splice showed that the webs had never fitted up close like they showed. They showed warped beside the cover plate where it had been riveted on.

Prof. KERRY.—It was buckling up, like ?

Mr. HALEY.—Where they meet together they do not meet flush ?

Prof. GALBRAITH.—They were open more in one part than in another ?

Mr. HALEY.—At the bottom corner one stuck out $\frac{5}{8}$ or a $\frac{1}{4}$ of an inch.

Prof. GALBRAITH.—Sideways ?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Were the side cover plates not opposite ?

Mr. HALEY.—That is what I am speaking of.

Prof. KERRY.—That is to say that the two sections would be something like that ? (indicating.)

Mr. HALEY.—Yes, they did not meet evenly.

Prof. KERRY.—How were the cover plates fastened at that time ?

Mr. HALEY.—The splice was all riveted up.

Prof. KERRY.—And the webs of the two adjacent pieces were not in line ?

Mr. HALEY.—No, sir.

Prof. KERRY.—Was the cover plate bent ?

Mr. HALEY.—Yes, it showed a bend right at the splice.

Prof. KERRY.—It had been actually hammered in together in contact and then riveted ?

Mr. HALEY.—Exactly; drawn in and jacked in until the metal was in contact and then riveted,

Prof. GALBRAITH.—Was there a similar appearance in the case of the inside splice or the cover plate on the other side of the girder ?

Mr. HALEY.—It is the splice plates I refer to on both sides.

Prof. GALBRAITH.—How many splice plates are there in the whole chord ?

Mr. HALEY.—Eight. There are four webs and two splice plates for each web.

Prof. GALBRAITH.—You are testifying now to Mr. Kerry about the condition of the outside splice plate ? That is what your previous testimony has been in reference to ?

Mr. HALEY.—The outside and inside, both.

Prof. GALBRAITH.—I am asking you about the inside. Were all of the splice plates—the eight splice plates you say were in that joint—deformed sideways ?

Mr. HALEY.—I did not look at the inside ones. In order to do that you would have to get down and look up and there was no scaffold.

Prof. GALBRAITH.—They were covered so that you could not see them ?

Mr. HALEY.—No, sir.

Prof. GALBRAITH.—You saw nothing on the inside splice plates?

Mr. HALEY.—At that time.

Prof. GALBRAITH.—You are clear on that?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—I understood you to say a little while ago that the inside splice plates were displaced. You withdraw that? You are not sure?

Mr. HALEY.—If you understand me right——

Prof. GALBRAITH.—We do not understand each other perhaps.

Mr. HALEY.—I am speaking of the inside web and the outside web. There are two centre webs. I did not look at them because you have to have a scaffold to look at them from underneath. There was no scaffold and consequently I did not look at them. But I had seen that splice. I had noticed it previously.

Prof. GALBRAITH.—And if there is anything taken down in the evidence referring to the splicing of the inside webs, you withdraw it? You say nothing about that?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—That is what I want to get clear.

Prof. KERRY.—Going back to the fact that the webs and the two members on each side of the splice did not line have you any idea whether that was there when the member was put up? And if so, for how long?

Mr. HALEY.—On August 8 I was down there. I was not here when the member was put up. I walked down from that bottom chord right down to the shoe and I noticed that there was a great change between August 8 and August 28.

Prof. KERRY.—You did not notice anything wrong at all in that member or in that joint on August 8?

Mr. HALEY.—I say yes; decidedly so. I noticed a great difference.

Prof. KERRY.—But on August 8 did it look all right?

Mr. HALEY.—No, it did not.

Prof. KERRY.—What looked wrong on August 8?

Mr. HALEY.—The plates were lying off on a scaffold. They were about to be riveted up. They were trying to get it in position to rivet it and they had four jacks there and they were trying to get these webs together flush so that they could rivet it.

Prof. GALBRAITH.—That is flush sideways?

Mr. HALEY.—Yes. That was August 8, and I did not see it any more till August 28. It was all riveted up then.

Prof. KERRY.—Were all the inside ribs out of line?

Mr. HALEY.—Yes.

Prof. KERRY.—It was all uncovered when you were there?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—Was each web on one side of a joint opposite each corresponding web on the other side of the joint?

Mr. HALEY.—No, they were not clear past, but they were projecting about half an inch.

Prof. KERRY.—Was each case the same way. Take the two webs on the Quebec side; we will say that one is projecting half an inch towards Quebec. Then, take the centre web; would that also be projecting half an inch towards Quebec?

Mr. HALEY.—Not necessarily. I noticed that. In one case two went one way and in the other case two were divided, one each way.

Prof. KERRY.—I think we might ask the witness to make a sketch showing how these did lie in the two cases. (Witness made a sketch which was filed and marked Exhibit 27.)

Prof. KERRY.—Jacks were being used to bend the cover plates in.

Mr. HALEY.—Jacks were being used right in between these webs to shove them together.

Prof. KERRY.—I notice that sections A, C and D of the 9th chord are shown in the sketch (Exhibit 27) as projecting towards Quebec and section B of the same chord is shown projecting towards Montreal. Is this correct?

Mr. HALEY.—That is correct?

Mr. HOLGATE.—Have you anything explaining that apparent discrepancy?

Mr. HALEY.—Too much weight being put on before the point was riveted.

Mr. GALBRAITH.—Is that your full answer to that question?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—What about the cover plate at that time?

Mr. HALEY.—It was not riveted—just bolted or partially bolted on the bottom.

Prof. GALBRAITH.—That cover plate was on chord No. 8?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—Riveted?

Mr. HALEY.—No.

Mr. HOLGATE.—We are speaking of this on the 8th or 28th of August.

Mr. HALEY.—On the 8th.

Prof. GALBRAITH.—How did you measure these displacements you speak of?

Mr. HALEY.—With a rule.

Prof. KERRY.—These are actual measurements?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—That was the only measurement you made, Mr. Haley?

Mr. HALEY.—The only measurement ever I made.

Prof. KERRY.—We have not yet examined the plans of the bridge. Were there any of the splice plates connected to the member when it arrived or were they all fastened to both members at the bridge?

Mr. HALEY.—I do not know how they arrived from the shops.

Prof. KERRY.—At the time of your inspection on August 8, were any of the joint plates riveted to the chord members?

Mr. HALEY.—No.

Prof. KERRY.—How many were in place and how were they fastened?

Mr. HALEY.—They were fastened by bolts and the splices placed inside and the ones on the outside as well. The splice was about two-thirds bolted up on the outside. Some holes had nothing in them at all.

Prof. KERRY.—And the inner splices?

Mr. HALEY.—I did not notice how many bolts were in them. It was dark up there.

Mr. HOLGATE.—Were there bolts in them at all?

Mr. HALEY.—Yes, there were some bolts up there.

Prof. KERRY.—Were the upper and lower cover plates in place?

Mr. HALEY.—The lower cover plate was lying on the scaffold and the upper one was in its place.

Mr. HOLGATE.—You had to see the joint from the scaffold?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—The upper cover plate was bolted?

Mr. HALEY.—I do not know how the upper plate was put on. I got right down underneath and laid down on my back and measured these points and looked up there.

Prof. GALBRAITH.—You measured from underneath?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Why did you not do it from the upper side?

Mr. HALEY.—The cover plate was put on. I could not see anything.

Prof. GALBRAITH.—Bolted or riveted?

Mr. HALEY.—I do not remember. It must have been bolted.

Prof. GALBRAITH.—The lower cover plate was completely off?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—And the side splice plates were in position?

Mr. HALEY.—Yes, sir; that is, they were hanging loosely—not exactly loosely either, but they were not full of bolts. The riveters had been there and were in the act of tightening them up and trying to get them in place.

Prof. GALBRAITH.—Did you make a careful count of the number of these spliced ones ?

Mr. HALEY.—No.

Prof. GALBRAITH.—I am not speaking of the bolts now. I am speaking of the plates themselves. Did you make a careful count of the number of splice plates on the sides of the rib ?

Mr. HALEY.—No.

Prof. GALBRAITH.—Are you sure as to the number of them ?

Mr. HALEY.—No, I am not sure whether there were two plates on the outside or one.

Prof. GALBRAITH.—Since that has that doubt entered your mind ?

Mr. HALEY.—I never looked closely.

Prof. GALBRAITH.—You testified a few moments ago that there were eight splice plates.

Mr. HALEY.—There were 4 webs. I took it for granted that there would be 8 splice plates.

Prof. GALBRAITH.—But you had an opportunity of seeing them ?

Mr. HALEY.—I know.

Prof. GALBRAITH.—You were testifying to what you had seen and you testified that there were 8 spliced plates ?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—Do you still testify to that effect ?

Mr. HALEY.—I could not swear as to whether there were 8 spliced plates or not because I did not count them.

Mr. HOLGATE.—And yet you measured these variations with a rule ?

Mr. HALEY.—Yes, sir; there were three of us and we noticed it in particular.

Prof. KERRY.—Will you mention the other two ?

Mr. HALEY.—The other two are Mr. Joe Ward and Mr. George Cook.

Prof. KERRY.—Were they both in the accident ?

Mr. HALEY.—Yes.

Mr. DAVIDSON.—No, Mr. Ward was drowned before.

Mr. HALEY.—Mr. Ward was drowned about two weeks before.

Mr. DAVIDSON.—They were both drowned ?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Are you sure about the direction of the displacement up or down the river that you have shown on this plan ?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Absolutely ?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—You cannot remember about that upper cover plate. You say that it was in position; you cannot remember whether the whole of it or part of it was riveted ?

Mr. HALEY.—I did not notice at all particularly. I jumped right down on the scaffold and looked at the bottom.

Mr. HOLGATE.—Was this variation that you have seen here the same all the way up the chord ?

Mr. HALEY.—No, it was not so bad at the top. It was dark up at the top, and it seemed as if it ran out.

Mr. HOLGATE. If that variation existed on the top of the chord would it have been possible to have had the cover plate bolted up ?

Mr. HALEY.—I do not think it would—not that much in.

Mr. HOLGATE.—How much variation in the abutting of these chord sections would be possible if the upper cover plate were bolted to both sections of the chord ? How much variation would there be in the holes to permit of any slight variation ?

Mr. HALEY.—The bottom could swing half an inch over and the top cover plate would hold.

Mr. HOLGATE.—How much variation on the top?

Mr. HALEY.—There could not be any.

Mr. HOLGATE.—Were the conditions such that they must have abutted properly on the top?

Mr. HALEY.—Pretty nearly so.

Mr. HOLGATE.—Then this variation you have marked on Exhibit 27 is the maximum divergence at the bottom?

Mr. HALEY.—Exactly.

Mr. HOLGATE.—Diminishing to nothing at the top?

Mr. HALEY.—It looked that way. It was dark up there and it looked to run out.

Mr HOLGATE.—Then you mean that there was a twist in one or other of these chord sections?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—Would you call that a wind?

Mr. HALEY.—Yes, a little wind in it. Instead of calling it a wind, it would seem more proper to say that it kicked to one side.

Mr. HOLGATE.—If it had done that would not that exist in the next joint of No. 9?

Mr. HALEY.—The next panel, you mean?

Mr. HOLGATE.—Yes?

Mr. HALEY.—In the splice down here (indicating)?

Mr. HOLGATE.—Yes?

Mr. HALEY.—I do not know that it is necessary for it—no. This is the panel point (indicating). I walked down the lower chord to the main pier and right up the other side, and my reasons for doing so were that I had never been there before. I simply went to see that big pin and big shoe, as I expected to quit—to leave the job.

Prof. KERRY.—The ribs of the chord were built of three pieces?

Mr. HALEY.—I do not know whether they were or not.

Prof. KERRY.—Were they tight together, or did you notice any bending in the rib?

Mr. HALEY.—They were tight together.

Prof. KERRY.—The rib itself was——?

Mr. HALEY.—Intact.

Prof. KERRY.—Intact?

Mr. HALEY.—I do not know whether there were three pieces or five pieces. You have to look very closely to tell how many pieces there are when they are tight together.

Mr. HOLGATE.—I was asking a little while ago when you discovered the joint illustrated on your sketch (Exhibit No. 27), did you examine the next joint in the chord in either direction?

Mr. HALEY.—No, sir; I walked straight down to the shoe. It is August 8 I refer to now.

Mr. HOLGATE.—Did it not occur to you that if one or other of these were out of place, in the shape in which you describe it, you might find something to explain it in the next joint?

Mr. HALEY.—All the explanation I wanted was the extreme load on the end of it and the point not riveted up.

Mr. HOLGATE.—As a matter of fact, you did not examine the other joints?

Mr. HALEY.—No, sir.

Mr. HOLGATE.—From where you were did you observe anything in either of these joints, or any other joint, or anything else, that in your mind was not correct?

Mr. HALEY.—Not on August 8.

Mr. HOLGATE.—Did you on August 28?

Mr. HALEY.—Yes.

Mr. HOLGATE.—From this point?

Mr. HALEY.—Yes.

Mr. HOLGATE.—That is panel point No. 9?

Prof. KERRY.—Now, we have looked into this distortion you saw on August 8, and you tell us you noticed several things. Will you tell us the others?

Mr. HALEY.—On August 28 I noticed several things.

Prof. KERRY.—You did not take particular notice of any other defects between August 8 and August 28?

Mr. HALEY.—No, sir.

Prof. KERRY.—No new ones developed?

Mr. HALEY.—No, sir.

Prof. KERRY.—What did you see on the 28th?

Mr. HALEY.—I saw this point as I described to you before, and I went right below it—this splice between chord 10 and chord 9. I saw the joints at panel point 9 and panel point 10 on the Quebec side of the cantilever arm, being the splice at the other end of chord 9 already referred to.

Prof. KERRY.—What condition were these joints in?

Mr. HALEY.—I stood up at the splice near panel point No. 9, and looking down at No. 10 you could see the bulge on both outside and inside.

Mr. HALEY.—On August 27, at 5.45 p.m., I went down to the joint near panel point 9 on the Quebec side of the cantilever arm and looked towards the main pier.

Prof. KERRY.—Now, go ahead and tell us what you saw.

Mr. HALEY.—I saw those bulges in this chord.

Mr. HOLGATE.—You saw bulges in the lower chord in panel 9, somewhere in panel 9 near panel 10.

Mr. HALEY.—Near the splice.

Prof. GALBRAITH.—About how long is that bulge?

Mr. HALEY.—That bulge there means about three feet and this one about two feet.

Mr. HOLGATE.—I have indicated the location of these bulges on the sketch marked '27—A.'

Prof. KERRY.—Will you mark the extent of that bulge out of line?

Mr. HALEY.—I stepped up here and took a look and it looked to me about an inch and a half.

Prof. GALBRAITH.—You had better put in the word 'apparently' because you did not measure it.

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—Where does it begin?

Mr. HALEY.—Just outside the splice.

Prof. KERRY.—It commenced just about the end of the spliced plate?

Mr. HALEY.—Yes.

Prof. KERRY.—I notice on the sketch, Mr. Haley, that only two of the ribs were bent, is that correct?

Mr. HALEY.—I just looked from the bed, I did not examine the centre ones.

Prof. KERRY.—You were standing on the lower chord at the time?

Mr. HALEY.—Yes, just over point 9.

Prof. KERRY.—Continue?

Mr. HALEY.—That is all I saw. On this chord directly opposite point 9 on the north side the same thing was visible.

Prof. GALBRAITH.—Panel 9?

Mr. HALEY.—Panel 9, yes, between points 8 and 9.

Prof. GALBRAITH.—You say that on the other side of the bridge directly opposite the panel point already spoken of, a similar thing was observed?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Where were you standing when you observed this?

Mr. HALEY.—I walked up across the ladders over there and stood on top and it was very visible and I did not make any further examination.

Prof. KERRY.—You stood at panel point 9 on the Montreal side?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—And were the bulges in the same direction?

Mr. HALEY.—The bulges I saw were just on the two outside, the same as this. I did not look on the inside. This splice was not riveted.

Prof. KERRY.—The splice on the Montreal side was not riveted?

Mr. HALEY.—The splice on the Montreal side was not riveted.

Prof. KERRY.—The plates were in place for riveting?

Mr. HALEY.—The plates were the way they had been left from the time it had been put up, the riveters had just got there and had not started in yet, just swung their scaffold.

Prof. KERRY.—Was there any displacement visible at this joint, were the webs out of line, or anything as in the other case?

Mr. HALEY.—Oh, yes, in connection with the webs, I did not look at these.

Prof KERRY.—The witness saw no displacement at the splice, he did not look for it.

Mr. HALEY.—But I saw the bulge, that was visible from the top in each side.

Prof GALBRAITH.—Outwards in both cases from the centre line of the chord?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—On the 28th were all the spliced plates at panel point 9 on the Quebec side in place?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—Splice and cover plates?

Mr. HALEY.—The cover plate on the bottom side, I do not know if it was there; I expect it was there, there was no scaffold under it and I did not get under it to look; I am not positive.

Prof. GALBRAITH.—You mean then that all the splice plates, the side plates and also the top cover plates were there, you do not know about the bottom cover plate?

Mr. HALEY.—No.

Prof. KERRY.—This is from outside observation without special examination?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—You just looked at it, you did not go into it to see?

Mr. HALEY.—Only I put a mark on it, that is all.

Mr. HOLGATE.—On your visit of the 28th, is not your recollection clear with regard to the bottom plate being fastened to the chords?

Mr. HALEY.—On the 28th I had no way of seeing the bottom at all.

Mr. HOLGATE.—Now on your examination of the 8th it was absent?

Mr. HALEY.—There was a scaffold there then, and it lay right on the scaffold?

Mr. HOLGATE.—And its absence and the presence of the scaffold there enabled you to make this very close observation?

Mr. HALEY.—Yes, sir.

Prof. HOLGATE.—The absence of that plate was rather a notable thing, was it not?

Mr. HALEY.—It was indeed, yes.

Mr. HOLGATE. Then on your second visit, is it not reasonable to think that your attention would be called almost first of all to the bottom plate?

Mr. HALEY.—No, no.

Mr. HOLGATE.—For this reason, I mean, I am only mentioning what is in my mind; its absence enabled you to make these observations before.

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—Now, then, you must know whether that plate was on at the time of your second examination, or whether it was not on?

Mr. HALEY.—Oh, no, not necessarily. I told you I stepped on the top of the chord.

Mr. HOLGATE.—The scaffold was gone and the plate not lying there.

Mr. HALEY.—Understand that the plate is four feet in depth and there is no way

of getting under unless you get a line and get under there, and I did not make that examination. It was enough for me. I said: I will put a mark on that, and if it is any worse to-morrow, I am gone from here.

Mr. HOLGATE.—A mark on what?

Mr. HALEY.—I looked all along the line of rivets, and the first rivet out beyond the rest I put a chalk mark on it; at least Mr. Cook did, and the second rivet was just half way out. That is, the plate had bulged so it was just half way.

Prof. GALBRAITH.—Which plate?

Mr. HALEY.—The outside one of the chord, and he drew a line half way across and I said: To-morrow night I am going to have a look at that and if that is gone any further we will be able to tell by looking at these rivets.

Mr. STUART.—That is the Montreal side?

Mr. HALEY.—That is the Quebec side.

Mr. HOLGATE.—Was it impossible for you to have seen whether or not the plate was on on the 28th?

Mr. HALEY.—Quite so.

Mr. HOLGATE.—You could not have seen whether that plate was in or not?

Mr. HALEY.—Well, I could have, I suppose, if I had gone to some trouble.

Mr. HOLGATE.—But you did not.

Mr. HALEY.—I did not, no.

Mr. HOLGATE.—Do you know in any other way, whether that plate was or was not on?

Mr. HALEY.—No, sir.

Mr. HOLGATE.—You have already said that if the top plate were in position that the holes would draw the chord sections together at the top?

Mr. HALEY.—Yes, sir,

Mr. HOLGATE.—Now, if the bottom plate had been placed on and bolted or riveted, would the remaining portion of the chord be brought into its proper position?

Mr. HALEY.—It would if it met the hole, but if they reamed away about three-quarters of an inch it would not.

Mr. HOLGATE.—Then all the holes would have to be reamed so as to fit the position correctly?

Mr. HALEY.—Yes, sir,

Mr. HOLGATE.—Do you know whether that was done or not?

Mr. HALEY.—I am not prepared to swear whether that was reamed or not.

Mr. HOLGATE.—Did you hear anything about it?

Mr. HALEY.—I know the reamers were working all the time around there.

Mr. HOLGATE.—Then the plate must have been on?

Mr. HALEY.—I could not tell you whether the plate was on or not, the bottom plate on the 28th.

Mr. HOLGATE.—If the reamers were working on it——

Mr. HALEY.—Because my attention was called so forcibly to this.

Mr. HOLGATE.—If you believed the reamers were working on it, you must have believed the plate was on?

Mr. HALEY.—I thoroughly believe the plate was on, because the point was all riveted up.

Prof. KERRY.—You mean there was a force of riveters working on the bridge, but not at this particular point?

Mr. HALEY.—Not at this particular point. I never saw anyone working with a reamer at this point, but I know there were reamers working at different points where they were needed.

Mr. HOLGATE.—You cannot say who put that plate on?

Mr. HALEY.—No, sir, I cannot tell you only what I know.

Prof. GALBRAITH.—Referring now to the corresponding panel point on the other side of the bridge, you saw that when?

Mr. HALEY.—On August 28.

Prof. GALBRAITH.—At what hour?

Mr. HALEY.—At a quarter of six, the same hour.

Prof. GALBRAITH.—Who were with you?

Mr. HALEY.—Mr. George Cook, Tom Callihan and Harry Briggs.

Prof. GALBRAITH.—Did you visit that after you had completed your observation of the joint you have spoken of?

Mr. HALEY.—Yes, sir, right after.

Prof. GALBRAITH.—Right after?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—How many splices or cover plates were attached to the chord at that time?

Mr. HALEY.—I simply looked at the two outside plates of the chords, and they were both attached, but they were not full of bolts.

Prof. GALBRAITH.—Was the top cover plate in position?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Was it riveted?

Mr. HALEY.—No, sir.

Prof. GALBRAITH.—It was bolted?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Did you see the bottom cover plate?

Mr. HALEY.—No.

Prof. GALBRAITH.—Not even from the side of the bridge first examined?

Mr. HALEY.—No, sir.

Prof. GALBRAITH.—Where were you standing when you made the examination of this joint?

Mr. HALEY.—On the top of the bottom chord.

Prof. GALBRAITH.—Was there anything to interfere with your view in looking across to the corresponding joint on the other side of the bridge? In other words, could you see underneath in any degree or did you try?

Mr. HALEY.—I did not try.

Mr. HOLGATE.—Where you saw the bulge in the two outside ribs of the lower chord in panel 9 in the Quebec side of the bridge, did you notice the effect that that bulging might have had on the lacing?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—You might describe what you saw?

Mr. HALEY.—I have already described that. In some places it was down, and in other places it was bent up.

Mr. HOLGATE.—Was the bulge, as you have shown it on sketch 27-A, exactly in the two outside ribs?

Mr. HALEY.—Well as I could come to it.

Mr. HOLGATE.—The bulge was in the opposite direction in the two ribs?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—So that the space between the centres of those two ribs would be the original distance apart, plus the total bulge on each side.

Mr. HALEY.—Yes.

Mr. HOLGATE.—Then were the lacing angles still attached to the chord?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—Were any of the connections broken?

Mr. HALEY.—No, sir.

Mr. HOLGATE.—Now, you have said that some of the lacing angles were bent up and some down. How do you describe that?

The witness described the lacing by means of the plan.

Mr. HOLGATE.—From what you have described here it would appear that the only tendency wouldl be to pull on these bars. I do not understand how any of them

could have been bent up; I speak now of the lacing angles. How do you account for any of them being bent up.

Mr. HALEY.—I will tell you, it is very simple to me. I did not describe any below here at all (indicating). I spoke of compresssion and when it shoves together, these things have naturally got to go some way or other.

Mr. HOLGATE.—Which, the lacing angles?

Mr. HALEY.—The lacing angles, yes.

Mr. HOLGATE.—Let us first of all confine ourselves to the bulge. Was there any change observable in the lacing bars at the bulge?

Mr. HALEY.—None that I could notice, but just behind the bulge.

Mr. HOLGATE.—Was there any observable distortion or bulge where you did notice the change in the shape of the angle lacing?

Mr. HALEY.—There was down in the centre of the chord. That is, I mean the centre of the outside web, the top and bottom edges of the outside web were separated by a very heavy angle, and this did not show so much as it did down in the centre; this bulge is down along in the centre.

Prof. GALBRAITH.—You are speaking now just of the outside rib?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—And there are angles on both top and bottom of the outside rib?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—You put your eye along the outside line of these angles, did you?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—This is the joint between 10 and 9 on Exhibit 27-A?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—The bulge outwards on each side you said was 1½ inches apparently out of line?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE suggested an adjournment in order that a sketch might be made by Mr. McLure for the use of the Commissioners in examining Mr. Haley, in order to avoid confusion in his evidence between the two sketches which had been used in his examination.

The Commission took recess.

AFTERNOON SESSION—FIFTH DAY.

EDWARD A. HOARE, Chief Engineer, Quebec Bridge Company, recalled.

Mr. HOLGATE.—Mr. Hoare, we asked you for some further papers to be put in?

Mr. HOARE.—One was in answer to that question, as to the number of times I visited the bridge during erection. I have written out my answer, thought over it and written it out. It was an incomplete answer. (Reading):

In answer to question as to number of times I visited the bridge during erection, I find that I have not noted each trip, as at times when work was active my trips were often daily. I can also positively state that with the exception of the time required for visits to Phœnix Bridge Company's works at Phœnixville, and for other official purposes, connected with the Bridge Company's business, my visits were at least three times a week. Having telephone communication from the Quebec office and my residence it was my daily custom, with few exceptions, to call the bridge office to know what kind of work was in progress or going to be done that day, and if it was preparation work or moving the traveller, I generally remained in the office.

I can also positively state that since the commencement of any kind of work for the Quebec Bridge Company I have never taken any vacation and have always

been within call and never off duty more than forty-eight hours at a time and then only once or twice a year.

You also asked me to file my professional record, to be more exact than the general information I gave you. This will take the place of my incomplete evidence; it is supplementary to my former evidence. I could not remember dates, I had to refer to some back records to get that statement. I submit this document:

PROFESSIONAL RECORD OF E. A. HOARE.

1866 to 1868 inclusive, in engineer's office, London, England, and on marine works connected with same.

1869 to end 1870, assistant engineer on Toronto, Grey and Bruce Railway.

1870 to 1872, resident engineer Great Northern Railway construction of Glencoe and Fort Erie loop line.

1873, after completion of loop line, appointed resident engineer on Wellington, Grey and Bruce branch lines between main line Great Western Railway and Lake Huron.

1873 to end of 1883. Appointed resident engineer by North Shore Railway Company on line between Quebec and Montreal, afterwards assistant chief engineer under commissioners appointed by provincial government of Quebec, to take over and complete the North Shore Railway between Quebec, Montreal and Ottawa, now a part of the Canadian Pacific Railway system.

1884 to 1889. Chief engineer and superintendent for H. I. Beemer, contractor on railway construction, terminals, work shops and water works.

From July 1889 to autumn of 1900. Chief engineer, Quebec and Lake St. John Railway and for about half that period at the same time chief engineer of Great Northern Railway between Rivière a Pierre Junction on Quebec and Lake St. John Railway and Hawkesbury, Ontario, the latter railway being controlled by the Quebec and Lake St. John Railway Company.

From last date to present time chief engineer Quebec Bridge and Railway Company.

Exclusive of the Quebec Bridge and Railway Company's works, the other work included about 27,000 feet of bridging, the majority being of steel on masonry piers and many deep water foundations.

Mr. HOLGATE.—Then there were certain reports of inspectors?

Mr. HOARE.—Yes, I would like to put on evidence a package of inspectors' reports that were sent to me by Mr. Edwards from Phœnixville, the chief inspector at Phœnixville.

(Three packages of papers produced, filed and marked as Exhibit No. 28.)

Mr. HOLGATE.—Then, Mr. Hoare, we want the diary of works.

Mr. HOARE.—The book I was showing you this morning, do you want that put on file?

Mr. HOLGATE.—I think we had better have that, yes. That dairy is what?

Mr. HOARE.—It is simply a daily record of erection. I might want to refer to that from time to time, could I get it?

Mr. HOLGATE.—Oh, it will always be available.

Mr. HOARE.—I have not a copy of it.

Mr. HOLGATE.—That was kept by——

Mr. HOARE.—It is the Quebec office record, I used to keep it in the office at Quebec.

Mr. HOLGATE.—And by whom was it written up?

Mr. HOARE.—Mr. McLure used to write it up for me.

Mr. HOLGATE.—So that the diary is Mr. McLure's diary?

Mr. HOARE.—Taken from his field notes so that I could refer to anything we were discussing. I could turn that diary up in the office in Quebec and we could under-

stand each other. We used to talk a good deal over the 'phone about these matters. I had one record in the office and he had his field record and in discussing any particular matter we had identically the same records. That is a list of the tests which I will deposit (producing document). They are as follows :—

Reports of:—

1. Full sized eye-bar tests.
2. Material tested at Phoenixville.
3. Material tested at Carnegie's mill.
4. Physical and chemical tests, Carnegie's mill.
5. Reports on condition of work at shops.
6. Physical and chemical tests at Central works, Harrisburg.
7. Physical and chemical tests at Central works, Harrisburg.
8. Physical and chemical tests at Phœnixville.

The witness retired.

D. B. HALEY re-called.

Prof. GALBRAITH.—You recognize that sketch as No. 9 chord and this as No. 8 chord?

Mr. HALEY.—This is the pier this way, is it?

Prof. GALBRAITH.—Now with reference to the bulging of the lattice bars which you spoke of this morning, will you kindly point it out on that diagram?

(Diagram filed and marked as Exhibit 27-B.)

Prof. GALBRAITH.—Now be very careful, this is the next.

The witness pointed to spots on the diagram which were marked by Prof. Galbraith.

Prof. GALBRAITH.—Those are the only three places you noticed a bulge? A, B and C. You noticed the bulges in the parts of the lacing marked by A, B and C on 27B?

Mr. HALEY.—These I paid particular attention to. There were other bulges there, but not so big as these.

Prof. GALBRAITH.—Did you observe any other bulging of the lacing? For instance, did you see anything on the bottom side of the chord?

Mr. HALEY.—No, I did not notice anything there; I did not look.

Prof. GALBRAITH.—Did you make any measurements of this bulging?

Mr. HALEY.—No, sir.

Prof. GALBRAITH.—Was the lacing curved horizontally, sideways, as well as up and down, either or both?

Mr. HALEY.—In some cases both and in some cases it was just sideways and not up at all.

Prof. GALBRAITH.—Each of these points was bulged down?

Mr. HALEY.—I could not tell you that.

Prof. GALBRAITH.—Which was bulged up?

Mr. HALEY.—It would take a very close inspection to remember all those little things. I distinctly saw that they were kinked and bulged out of shape.

Prof. GALBRAITH.—But you cannot specify each particular portion where any special bulging took place?

Mr. HALEY.—No, sir.

Prof. GALBRAITH.—Where were the bulges that you testified to this morning of the chord ribs in relation to this? Would you kindly mark them on the drawing? (Referring to Exhibit No. 27B.)

Prof. KERRY.—You show the bulge on the 8th chord? Was the bulge on the 8th chord?

Mr. HALEY.—It was on both of them.

Prof. KERRY.—Where were you standing?

Mr. HALEY.—I was standing at the panel point between 8 and 9.

Prof. KERRY.—Then the bulge that you saw was on panel 8 or panel 9? Was it the first piece from the pier?

Mr. HALEY.—It was the second piece.

Prof. KERRY.—That is panel 9 then? The sketch you showed was of panel 8.

Prof. GALBRAITH.—Were you standing on chord 8 or 9?

Mr. HALEY.—On chord 8.

Prof. KERRY.—You were on the third panel from the pier?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—And the failure was under your feet?

Mr. HALEY.—Just ahead of me, two or three feet ahead of me looking towards the pier.

Prof. GALBRAITH.—You have already said you could not particularize as to the bulges, that you could not state which was up and which was down. Were there any side bends in the lacing?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Can you specify the side bends?

Mr. HALEY.—I could not point out definitely as to each one. I could see they were on a line.

Prof. GALBRAITH.—Did you notice whether there was any disturbance in the next panel of lacing behind you?

Mr. HALEY.—No, sir, I did not notice that.

Prof. GALBRAITH.—This was the only place where you noticed a disturbance in the lacing in chord 8?

Mr. HALEY.—In chord 8—yes, sir.

Prof. GALBRAITH.—Going past the post, looking along chord 9 to the centre pier, did you observe any disturbance in the lacing.

Mr. HALEY.—No, sir, I did not look at the lacing at all.

Prof. GALBRAITH.—Did you look at the ribs?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Did you notice any disturbance in the ribs?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—Would you kindly mark on the plan (Exhibit No. 27B) what you saw?

Mr. HALEY.—(Witness marked on plan and added): I saw both outside ribs warped in and out in approximately the two southern lacing panels in chord 9 which I have indicated on Exhibit No. 27B.

Prof. GALBRAITH.—You are speaking in the common way, you can call it either south or east?

Mr. HALEY.—You can call it either south or east.

Prof. GALBRAITH.—But we will call it for this purpose the south side.

Mr. HALEY.—All right.

Prof. GALBRAITH.—Can you particularize the shapes of the bulges on these two panels of lacing?

Mr. HALEY.—No, sir. All I can say is that they were somthing like an S.

Prof. GALBRAITH.—I am speaking of the lacings?

Mr. HALEY.—I did not notice these lacings.

Prof. GALBRAITH.—Can you particularize the deformation, bending, warping, or whatever you may call it, of the two ribs?

Mr. HALEY.—It was about an inch deviation in each. I stood upon chord 8 near this piece.

Prof. GALBRAITH.—You do not remember the number of bends in the length you have shown here?

Mr. HALEY.—No.

Prof. GALBRAITH.—Would there be two bends?

Mr. HALEY.—Yes, two or three.

Prof. GALBRAITH.—We are now discussing the joint between 9 and 10 and you have stated what you know about the bends in the outside ribs of chord 9 at that joint?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—The splice marked X on Exhibit No. 27A is the splice marked in the same manner on Exhibit 27B?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—Are the two bulges marked on Exhibit 27A in the neighbourhood of the said splice the same bulges marked on Exhibit No. 27B, in the corresponding place? Do they represent the same bulges?

Mr. HALEY.—Yes.

Prof. GALBRAITH marks the joint referred to on Exhibit No. 27 as Y and also the corresponding joint on Exhibit No. 27B and continues: You say that the joint marked Y on Exhibit Nos. 27 and 27B represent the same joint?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—On Exhibit 27B I see no reference to any bulging of the ribs. Did these ribs bulge?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—How did they bulge?

Mr. HALEY.—They bulged out sideways.

Prof. GALBRAITH.—To what extent?

Mr. HALEY.—To the extent I have marked here.

Prof. GALBRAITH.—What is the length of the bulges?

Mr. HALEY.—I never measured.

Prof. GALBRAITH.—Estimate?

Mr. HALEY.—Two or three feet—a little bit longer on the Quebec side.

Prof. GALBRAITH.—That is on this side?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—About the deflection—the springing?

Mr. HALEY.—I should say two inches.

Prof. GALBRAITH.—Did you measure it?

Mr. HALEY.—No, sir.

Prof. GALBRAITH.—You estimate the springing to be about two inches on the Quebec side?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—How much was the deflection on the Montreal side?

Mr. HALEY.—About an inch.

Prof. GALBRAITH.—Now we refer to splice X. Can you give, approximately, the length of the bended portion on each side of the chord?

Mr. HALEY.—No, sir.

Prof. GALBRAITH.—Can you give an estimate of the bended portion on each side of the chord?

Mr. HALEY.—I think it was about an inch. I estimated it.

Prof. GALBRAITH.—Was the length of the bended portions of the ribs on this splice about the length of two panels of lacing?

Mr. HALEY.—Yes, sir, to the best of my judgment.

Prof. GALBRAITH.—And there were bends on each side, how deep?

Mr. HALEY.—About an inch.

Prof. GALBRAITH.—On both sides?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—More than one on each side?

Mr. HALEY.—Yes, two or three of them.

Prof. GALBRAITH.—Shall I put down two or three?

Mr. HALEY.—Well, it is not definite, you know.

Prof. GALBRAITH.—That diagram is now correct, is it?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—At what time did you observe the bent ribs at splice X on Exhibit 27 B?

Mr. HALEY.—August 28.

Prof. GALBRAITH.—At what time did you observe the corresponding appearances at splice Y on the same exhibit?

Mr. HALEY.—August 28.

Mr. HOLGATE.—In what condition did you find the corresponding points on the Montreal side of the bridge?

Mr. HALEY.—I just noticed one point on the Montreal side on No. 8 chord.

Mr. HOLGATE.—Was that corresponding in position to point Y on 27 B?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—Directly opposite to it?

Mr. HALEY.—Yes.

Mr. HOLGATE.—On the western chord?

Mr. HALEY.—On the Montreal side chord.

Mr. HOLGATE.—Did it differ in any particular from what you noticed at point Y?

Mr. HALEY.—It was just about the same, but not so much.

Mr. HOLGATE.—How did you get at it? Were you on the chord?

Mr. HALEY.—I simply walked across on the bottom laterals.

Mr. HOLGATE.—Would you find out from very close inspection on the spot where the trouble was?

Mr. HALEY.—Yes.

Mr. HOLGATE.—You may describe what that was as you found it?

Mr. HALEY.—It was very much the same as on this side.

Mr. HOLGATE.—It was very much the same as on the Quebec side?

Mr. HALEY.—Yes, I noticed some lacings were out of place and I could notice the side waving.

Mr. HOLGATE.—The side of the chord?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—One side or two sides?

Mr. HALEY.—Both sides.

Mr. HOLGATE.—Was there very much bulging there?

Mr. HALEY.—Bulging signifies one bulge in one place, but at this place it was waving just like a snake, two or three deviations from the straight line that it should be.

Mr. DAVIDSON.—In and out?

Mr. HALEY.—Yes.

Mr. HOLGATE.—Did you make any measurements of that?

Mr. HALEY.—No.

Mr. HOLGATE.—Did you notice any defect that the change of shape had upon the lacing?

Mr. HALEY.—I noticed that the lacing was out of place.

Mr. HOLGATE.—In what way?

Mr. HALEY.—Kicked sideways and bent.

Mr. HOLGATE.—Was that visible both on the top chord and bottom chord?

Mr. HALEY.—I did not notice on the bottom of the chord; just on the top of the chord.

Mr. HOLGATE.—Were the lacing angles bent?

Mr. HALEY.—Yes.

Mr. HOLGATE.—Were the angles that passed across at right angles to the chord distorted or broken in any way?

Mr. HALEY.—No, they were not broken, but they showed that they had too much strain.

Mr. HOLGATE.—How would they show that?

Mr. HALEY.—By being warped a little bit. I walked just across one on the

diagonals but I just noticed these cross ones. They were a little bit warped at the top of the perpendicular angles.

Mr. HOLGATE.—Were any ribs connecting them to the chords broken?

Mr. HALEY.—No, sir, I did not notice any.

Mr. HOLGATE.—Is there anything else there that you notice? Is it fully described?

Mr. HALEY.—I have pretty fully described all I saw.

Mr. HOLGATE.—I mean about that particular point?

Mr. HALEY.—It is pretty fully described. It was not full of bolts.

Mr. HOLGATE.—That splice was not.

Mr. HALEY.—Yes. It was about two-thirds full of bolts and some of them were § bolts.

Mr. HOLGATE.—That is the joint on the Montreal side?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—Between 8 and 9?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—What proportion of it was bolted?

Mr. HALEY.—About two-thirds.

Mr. HOLGATE.—Was it riveted at all?

Mr. HALEY.—No, sir.

Mr. HOLGATE.—What proportion of these bolts would be ⅞ and what proportion §?

Mr. HALEY.—I could not say—a very small proportion, but I noticed some.

Mr. HOLGATE.—How could you tell a § from a ⅞ bolt?

Mr. HALEY.—It is very easy for me; I have been in the business nine years.

Mr. HOLGATE.—After nine years of experience you might have an idea of the proportion one to the other?

Mr. HALEY.—If I had noticed it closely enough. I could just see the bolts there and I noticed that.

Mr. HOLGATE.—I suppose that to some extent § bolts were necessary on that work?

Mr. HALEY.—I expect they were when you could not get holes for big bolts.

Mr. HOLGATE.—Could you say that there were more § bolts there than were necessary at that point?

Mr. HALEY.—I am not prepared to say that. It did not look to me as if § bolts should have been used there at all.

Prof. GALBRAITH.—Was there any side displacement at that splice and the ends of the adjoining chords?

Mr. HALEY.—I did not look at that closely.

Prof. KERRY.—When you were talking about that splice this morning, Mr. Haley, you said that the web was out of line about § of an inch?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—Did they bring these webs back into line with a jack before they riveted them?

Mr. HALEY.—I could not swear to that.

Prof. KERRY.—You do not know whether they jacked them back into line?

Mr. HALEY.—They evidently helped them some, because I could see on August 28 on the splices the cover plate was drawn in for rivets and there was a bend in it right at this splice.

Prof. KERRY.—The cover plate was not flat?

Mr. HALEY.—No, showing that the splice had never been pulled into shape. That was on the bottom and I got down there and inspected it closely.

Prof. KERRY.—Was it like a regular crimp or a long bend?

Mr. HALEY.—It was a bend that was put in there with an 8-pound maul.

Prof. GALBRAITH.—Are you speaking now of a joint on the Quebec side of the bridge or a joint on the Montreal side of the bridge?

Mr. HALEY.—A joint on the Quebec side of the bridge.

Mr. HOLGATE.—Were there any other points that you wanted to draw our attention to, Mr. Haley, that you observed?

Mr. HALEY.—Not about this steel work. I have explained about all I know about it.

Mr. STUART.—Before you leave that would you mind getting exactly who accompanied him on the occasion of each of these visits?

Mr. HOLGATE.—Who accompanied you on the occasion of each of these visits?

Mr. HALEY.—On August 8th there was Mr. Joe Ward and Mr. George Cook.

Prof. GALBRAITH.—Are they alive now?

Mr. HALEY.—No sir, and on August 28th there were Mr. George Cook, Mr. Tom Callahan and Mr. Harry Briggs.

Prof. GALBRAITH.—Are the last two alive?

Mr. HALEY.—All three dead.

Prof. KERRY.—You noticed no other defect on the bridge?

Mr. HALEY.—No, sir.

Prof. KERRY.—That is all the defective work you know of?

Mr. HALEY.—All the defective work on the bridge; yes, sir.

Mr. HOLGATE.—And you paid no other visit but these two to these points?

Mr. HALEY.—No, sir.

Prof. GALBRAITH.—Do you identify this drawing as representing the west or Montreal chord that is referred to in your previous evidence?

Mr. HALEY.—Yes, sir. (Drawing put in, filed and marked Exhibit No. 27C.)

Prof. KERRY.—I did not follow you this morning. You said that you made a mark on the chord on the 28th and you were going to go back to see it on the 29th.

Mr. HALEY.—Yes, sir.

Prof. KERRY.—Tell me again how that mark was made and what the mark was.

Mr. HALEY.—I sighted the rivets right along the chord and I had Mr. Cook go down with a piece of soapstone and mark the first rivet I noticed that was out of line sticking up higher than the rest in the row.

Prof. KERRY.—What was the row of rivets holding together?

Mr. HALEY.—The outside web on the Quebec side of chord No. 8.

Prof. KERRY.—That is the outside vertical web?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—One side of the chord?

Mr. HALEY.—Yes.

Prof. KERRY.—And you sighted along one of these?

Mr. HALEY.—Yes, and——

Prof. KERRY.—And he marked the first one that was out of line.

Mr. HALEY.—Out of line.

Prof. KERRY.—And then?

Mr. HALEY.—He went a little ways further and marked another. He went far enough to get one that was half way out. One was out half way—half of the head higher than the rest of the rivets—and he made a mark around this rivet, and we figured on coming around again on Thursday night to investigate after quitting time to see if any of these rivets had been shoved any further out. I was afraid of it myself. That is the reason I marked it.

Prof. KERRY.—What was shoving out?

Mr. HALEY.—The sides of chord No. 8.

Prof. KERRY.—They were shoving out and the tops of these rivets were along the top of the chord?

Mr. HALEY.—The chord was bulged. That portion (exhibiting a diagram) represents the whole depth of the chord and this is the row of rivets. As I looked along that I came to the first rivet I noticed that was out of line and I had him mark it.

Prof. KERRY.—It is riveted on the side?

Mr. HALEY.—Yes, sir; and a little way farther he got a rivet that was half way up and he marked it all around the rivet.

Prof. KERRY.—I do not follow yet which line of rivets that was.

Mr. HALEY.—The second row of rivets; a little below the angle.

Prof. KERRY.—So that it was bent up or out?

Mr. HALEY.—Bent out. Part of it was straight and then you would come to a bend and as you looked along the row you would see this sticking out. I was looking along horizontally.

Prof. GALBRAITH.—Could you see the neck of the rivet under the head?

Mr. HALEY.—No, I mean that this sheet (demonstrating with sheet of paper) was projected out and that this rivet (indicating) showed up more than the rest.

Mr. HOLGATE.—You would be standing on the bottom lateral?

Mr. HALEY.—No, sir, on my knees on the top of the bottom chord looking over the edge.

Mr. HOLGATE.—When you got this information what use did you make of it?

Mr. HALEY.—This information?

Mr. HOLGATE.—Yes, about these matters?

Mr. HALEY.—Why I simply made the remark that if I noticed any more to-morrow night, I was going, I was going from the job.

Mr. HOLGATE.—What I meant is, did you consider it important enough to state it to your foreman?

Mr. HALE.—Oh, yes, I told it to several of them.

Mr. HOLGATE.—I mean your own foreman?

Mr. HALEY.—Yes, I rode from work in a carriage with Tom Aderholdt, Worley, and Arthur Meredith.

Mr. HOLGATE.—Didn't you see Mr. Yenser between this time and the time of the accident?

Mr. HALEY.—No, sir, I saw him down on the deck under me the next day when I was working but I didn't see him to talk to.

Mr. HOLGATE.—You did not mention it to Mr. Yenser?

Mr. HALEY.—Oh, no, those people only laughed at me. Yenser was scared to death, anyhow.

Prof. KERRY.—Was that positive knowledge Mr. Haley or just hearsay?

Mr. HALEY.—What?

Prof. KERRY.—The statement that you made about Mr. Yenser?

Mr. HALEY.—It is positive, I do not suppose he was scared to death, it did not kill him.

Prof. KERRY.—What ground have you for making that statement?

Mr. HALEY.—I have these grounds. I slid down from the traveller on a line in the morning to go to the toilet which was down on the lower chord very close to this defective chord and I saw the red stringers, that is the temporary floor stringers used to get the load out all standing in front of the office and I noticed after a while again that they went back to the yard again and I heard the report that Mr. Yenser would not place them, that his life was in danger as much as anybody else's. I did not hear that myself, that is second hand.

Mr. HOLGATE.—Who told you that?

Mr. HALEY.—Mr. Brittain, over there.

Mr. HOLGATE.—But you see it would look to me this way: that whereas you might place great importance on these matters now, that at that time you might not have placed the same importance on these things that you observed, and the fact of your going out to work and the other men going out to work rather shows that you did not consider these things of as great importance then as you might now. I thought that would be probable, a natural way of looking at it.

Mr. HALEY.—Well it fooled us, we did not think it would go so quick, that is all.

Mr. HOLGATE.—Your own idea was that you did not think them so serious as to keep you from working on the bridge?

Mr. HALEY.—I thought them very serious, but I thought surely I would have a chance to look at them the next night.

Mr. HOLGATE.—You are a man of experience in bridge building I take it. Now in the methods used there with regard to erection was ordinary care used?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—And the appliances that were used——

Mr. HALEY.—Were very good.

Mr. HOLGATE.—Were they very good?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—When you consider the exceptional character of the work you consider them very good?

Mr. HALEY.—With one or two exceptions. One exception in particular where they landed the bottom chord section with a channel that had I think six bolts, and I was always afraid of that. Of course I was not under it, I was on top of everything. That is the only thing that I did not like.

Mr. HOLGATE.—Did you see any of these operations?

Mr. HALEY.—Oh, yes.

Mr. HOLGATE.—And were they carried out successfully?

Mr. HALEY.—Oh, yes, there was never anything happened from it.

Mr. HOLGATE.—And had you confidence in Mr. Yenser?

Mr. HALEY.—Well, while I hadn't known him very long—but Mr. Yenser did not have much to say there.

Mr. HOLGATE.—Still I understand that he was the foreman in charge of that work?

Mr. HALEY.—Yes, sir.

Mr. HOLGATE.—I mean as foreman in charge of the work, did you think that he understood his work?

Mr. HALEY.—Yes, he knew his business. It was very evident he did when he didn't want to move that traveller.

Mr. HOLGATE.—As you understand it, was Mr. Yenser in supreme charge of that work?

Mr. HALEY.—Well he was not in supreme charge of the work. He had charge of hiring men and discharging them, but otherwise he was dictated to by three or four around there. His principal part of the work as I could understand it was to keep the men busy and use them to the best advantage, in the best places, &c.

Mr. HOLGATE.—Who were these then that you say could dictate to Mr. Yenser?

Mr. HALEY.—Mr. Birks, Mr. McLure and Mr. Kinloch, they all had their say; so had Mr. Milliken.

Mr. HOLGATE.—But it all came down then, did it not, to this, that Mr. Yenser did the work?

Mr. HALEY.—Oh, yes, he was in charge of the men.

Mr. HOLGATE.—The actual carrying out of the work that was done was by Mr. Yenser?

Mr. HALEY.—Issuing the orders; yes, sir.

Prof. GALBRAITH.—In saying what you have said are you giving simply your impression of the official organization of the work or are you simply giving an opinion that has no reference to the organization but simply to what you saw and felt and knew and heard?

Mr. HALEY.—I am giving my opinion as a man who has been on the job every day and saw how things went one day with another.

Mr. HOLGATE.—Should we understand from what you say that there was conflict of authority?

Mr. HALEY.—No, I do not believe that.

Mr. HOLGATE.—Or was it all in the way of discussion between Yenser and Birks and McLure from time to time?

Mr. HALEY.—Yes, there were discussions from time to time.

Mr. HOLGATE.—Well, is that not what you might expect on a work like that, that they would discuss these matters together?

Mr. HALEY.—Yes, of course.

Mr. HOLGATE.—Well, then, there was nothing out of the ordinary ?

Mr. HALEY.—You asked me if Mr. Yenser was not in full charge? Yes, I simply said that he was after these people had their say so. Well, now, that is what I mean.

Mr. HOLGATE.—With regard to these matters that you noticed and which you have fully described to us, did you mention them to Mr. Kinloch or to Mr. McLure?

Mr. HALEY.—About this splice?

Mr. HOLGATE.—Yes, any of this?

Mr. HALEY.—They know more about it than I did.

Mr. HOLGATE.—Did you mention it to them?

Mr. HALEY.—No, I did not see them from the first time I noticed the defect until it was wrecked, I never saw them.

Prof. KERRY.—Turning again to the question of Mr. Yenser, I did not understand your statement very clearly, Mr. Haley, and to illustrate it could you tell us from your own observation any instances in which Mr. Yenser did anything against his own judgment on the advice of the gentlemen you have been referring to?

Mr. HALEY.—Well he moved out this traveller against his own judgment the last time.

Prof. KERRY.—Now, do you know that, or is that just hearsay ?

Mr. HALEY.—I know that.

Prof. KERRY.—On what evidence?

Mr. HALEY.—Well, I heard him talking to Birks.

Prof. KERRY.—You overheard the conversation?

Mr. HALEY.—Yes, sir, Mr. Birks that is killed.

Prof. KERRY.—Can you relate that conversation with any distinctness.

Mr. HALEY.—Yes, sir, I can relate it just as it happened.

Prof. KERRY.—Well, go ahead.

Mr. HALEY.—I heard him say: 'Why in hell don't they let me take down this traveller?'

Prof. GALBRAITH.—That was Mr. Yenser?

Mr. HALEY.—This big traveller and get that God damn load off of there before they put up more steel on the end of it.

Prof. GALBRAITH.—He said this to Mr. Birks?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—Did others besides you hear him?

Mr. HALEY.—Well, Mr. Cook must have heard, we were right together, we were on top of the traveller and they were on the top chord, only a distance of about 15 or 20 feet.

Prof. KERRY.—Was that the whole of the conversation?

Mr. HALEY.—That is about all I heard, they were talking away, the wind was blowing quite hard.

Mr. KERRY.—You did not hear Mr. Birks' reply?

Mr. HALEY.—Mr. Birks replied, but I did not hear what he said.

Mr. HOLGATE.—Whom do you suppose Mr. Yenser referred to by 'they?'

Mr. HALEY.—Well, I expect he referred to the Phœnix Bridge Company and the Quebec Bridge Company, his overseers, whoever they might be.

Prof. GALBRAITH.—Which traveller are you speaking of?

Mr. HALEY.—The big traveller, the 600 ton traveller.

Prof. GALBRAITH.—When did they begin taking down the big traveller?

Mr. HALEY.—Well, I could not give you the exact date, but I should think it was a month ago, anyhow.

Prof. GALBRAITH.—And was the progress apparently unnecessarily slow ?

Mr. HALEY.—Well, it was very slow, but they had a small force of men and bad weather ; they were very short of men.

Prof. GALBRAITH.—Was there any reason for that that you know of?

Mr. HALEY.—Yes, indeed, there is lots of reasons for that.

Prof. GALBRAITH.—Would you kindly describe what you thought were the reasons?

Mr. HALEY.—The principal reason for being short of men was that when they would go to the United States and ship men up here, if the men got dissatisfied with their job and quit, they would deduct the transportation out of their wages, which the men regarded as a plain public steal, and, of course, when they went back to the United States—they had to stand for it here, or else fight out all the money they had in law —and when they went back to the States the consequence was they told their brothers. That is why they were short of men.

Prof. GALBRAITH.—When was that first apparent on the work that they were short of men?

Mr. HALEY.—All this summer.

Prof. GALBRAITH.—Were there any strikes on the work?

Mr. HALEY.—There was one.

Prof. GALBRAITH.—At what time?

Mr. HALEY.—August the 8th.

Prof. GALBRAITH.—How long did it last?

Mr. HALEY.—Three days.

Prof. GALBRAITH.—Did all the men go back who were on strike?

Mr. HALEY.—No, sir, some of them had the good sense to go away and save their lives.

Prof. GALBRAITH.—Did any go back?

Mr. HALEY.—Oh, yes, quite a number went back.

Prof. KERRY.—What was the cause of the strike?

Mr. HALEY.—This same argument I have been telling you about deducting this fare, and they had a signed up agreement to pay the men at the rate of 50 cents per hour for every hour worked, signed by Mr. Milliken, the superintendent.

Prof. KERRY.—The question of the safety of the structure did not come up in any connection there?

Mr. HALEY.—No.

Prof. KERRY.—Now, what time in the morning did you hear that conversation between Mr. Yenser and Mr. Birks?

Mr. HALEY.—When they were moving out the traveller.

Prof. KERRY.—That was Wednesday morning?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—About what hour?

Mr. HALEY.—I guess about nine o'clock.

Prof. KERRY.—It would be the 28th of August about 9 in the morning?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—You say when moving out the traveller; I understood from the previous evidence that they were taking down the traveller?

Mr. HALEY.—There are two travellers.

Prof. GALBRAITH.—You are now speaking of the small traveller?

Mr. HALEY.—Yes.

Prof. GALBRAITH.—Moving forward to the next span?

Mr. HALEY.—Yes, sir.

Prof. GALBRAITH.—And did you ever discuss with Mr. Birks the defects in the structure, Mr. Haley?

Mr. HALEY.—Yes, sir.

Prof. KERRY.—What time was this?

Mr. HALEY.—Just about 15 minutes before Mr. Yenser came along.

Prof. KERRY.—That is on the Wednesday morning?

Mr. HALEY.—Yes.

Prof. KERRY.—Could you relate what occurred?

Mr. HALEY.—He was talking to another man, Mr. Durand, a man who is dead now. He says, it is all foolishness those fellows talking that way, if Haley hadn't gone down to look at that nobody would be a bit alarmed.

Prof. KERRY.—Who said this, Birks ?

Mr. HALEY.—We were sitting above his head and heard it and listened to what he said, and I said, it is perfectly safe, isn't it Birks? and he looked up and smiled and answered, why, certainly it is ; you fellows are getting alarmed prematurely ; there is nothing to cause any alarm. We told him we did not think so; we did not agree with him.

Prof. KERRY.—That was the end of the discussion ?

Mr. HOLGATE.—In the conversation that you overheard between Mr. Yenser and Mr. Birks, you could not say just now who you think Mr. Yenser referred to by using the word 'they ?' What I want to get at is who were Mr. Yenser's overseers, who would give him orders ?

Mr. HALEY.—Well, in this case Mr. Milliken was not here and Mr. Hoare had been on the job and I think they were orders from him. Of course I do not know who gave him his orders.

Prof. GALBRAITH.—When had Mr. Hoare been on the job ?

Mr. HALEY.—Mr. Hoare had been on the job I understood, he was on the job on Tuesday. I never saw him on the job, but there was a great deal of talk among the men.

Prof. KERRY.—Talk to what effect, Mr. Haley ?

Mr. HALEY.—About the bridge being unsafe and the fact that they sent those stringers back to the yard made a good deal of talk. Mr. Yenser refused to put them in place, saying his life was in danger as well as others.

Prof. KERRY.—Did you hear him say that ?

Mr. HALEY.—No.

Prof. KERRY.—Did you ever hear him say anything of that nature ?

Mr. HALEY.—No.

Mr. HOLGATE.—The whole object of this inquiry is to get as much real information as we can get.

Mr. HALEY.—All I have told you is true and I have not told anything I do not know.

Mr. HOLGATE.—Quite so. Is there anything else that you know in connection with the matter ?

Mr. HALEY.—No, I cannot say there is anything else I can tell you.

Prof. KERRY.—We want to get at information little or big, Mr. Haley, we want to get everything that was observed about the bridge. It might be that some things would be observed that would not be considered to have any bearing on the question, and yet on investigation may prove to have had something to do with it.

Mr. HALEY.—I could not give any light on anything like that, because I did not notice any.

Mr. HOLGATE.—From your intercourse with the various men on the work, whom do you know who can give us any information outside of the names that you have mentioned?

Mr. HALEY.—I know Mr. Splicer can. I see you have J. J. Nance. Those who knew the most about it are killed. Mr. Britton and Mr. McCumber there—that is about all I recollect just now.

Mr. HOLGATE.—Are you aware of any discussions having taken place with regard to the delay in moving forward the little traveller? Were you present at this conversation ?

Mr. HALEY.—No, I have already stated all the conversations I have heard, but as to being aware, I was well aware it was a well known fact among the men.

Mr. HOLGATE.—You have the same general knowledge as the other men in connection with that matter.

Mr. HALEY.—I had a little more knowledge than some of them, that is, not the discussions, but I had a little more knowledge of what the discussions were about on account of inspecting this the night before; some had not gone to that trouble.

Mr. HOLGATE.—What discussions ?

Mr. HALEY.—Just what I stated about Mr. Birks and Mr. Yenser. My position was up there, I wasn't around the part where the discussions were, the office.

Mr. HOLGATE.—Is that the only discussion you know of ?

Mr. HALEY.—Yes, sir, presently.

Mr. HOLGATE.—You do not know of any other discussions ?

Mr. HALEY.—I did not hear any. The discussions we had going home in the carriage with these other foremen and that I suppose does not count ; that is not on the subject.

Witness discharged.

DOMINIQUE MCCUMBER sworn.

Prof. KERRY.—What was your job on the bridge ?

Mr. MCCUMBER.—Erecting.

Prof. KERRY.—Were you working the day of the accident ?

Mr. MCCUMBER.—Yes, sir.

Prof. KERRY.—What part ?

Mr. MCCUMBER.—I worked till two o'clock in the afternoon.

Prof. KERRY.—You quit at two o'clock ?

Mr. MCCUMBER.—Yes.

Prof. KERRY.—You did not see the accident ?

Mr. MCCUMBER.—No.

Prof. KERRY.—Had you been over the bridge pretty much ?

Mr. MCCUMBER.—Yes, every day I worked I was over there.

Prof. KERRY.—Did you see any parts of it that were in bad shape ?

Mr. MCCUMBER.—Yes, one part.

Prof. KERRY.—Which was that ?

Mr. MCCUMBER.—That is the sixth joint from the pier.

Prof. KERRY.—That is on the overhang ?

Mr. MCCUMBER.—That is on the anchor arm, yes.

Prof. KERRY.—The sixth joint from which pier ?

Mr. MCCUMBER.—From the main pier.

Prof. KERRY.—From the main pier ?

Mr. MCCUMBER.—Yes.

Prof. KERRY.—What was the trouble with it ?

Mr. MCCUMBER.—Well, of course, I did not know but those fellows that worked there told me that the joint was giving out, that is, a fellow by the name of Joe Mitchell, an Indian, who is dead, he is the one who told me. I looked around where the joint was and I could not see it. I did not pay much attention to it until they sent me down there to work reaming out some holes in the side webs.

Prof. KERRY.—That was which day ?

Mr. MCCUMBER.—Tuesday, Tuesday morning.

Prof. KERRY.—To ream out some holes ?

Mr. MCCUMBER.—Inside holes, inside the web ; yes.

Prof. KERRY.—Was that on the part that ran out over the water or the part running back on to the shore ?

Mr. MCCUMBER.—Over the water.

Prof. KERRY.—The part running back over the water, the sixth joint on the pier ?

Mr. MCCUMBER.—Yes, on the down stream side.

Prof. KERRY.—On the Quebec side ; you were reaming out some holes in the inside web ?

Mr. MCCUMBER.—Yes, in the bottom chord.

Prof. GALBRAITH.—That is on the cantilever arm, the sixth point joint out ?

Mr. MCCUMBER.—Yes. sir.

Prof. GALBRAITH.—Watch me count on the chart, centre post, 1, 2, 3, 4, 5, 6 ; is that the place ?

Mr. MCCUMBER.—That is the place.

Prof. GALBRAITH.—Which side of the pin is the joint there?

Mr. MCCUMBER.—On the north side, on the river side, towards the traveller.

Prof. KERRY.—You were right by the floor beam, by the closet ?

Mr. MCCUMBER.—Right by the floor beam, yes.

Prof. KERRY.—What did you see that was wrong ?

Mr. MCCUMBER.—Well, the jacks was in there, they had some jacks in there, and I asked Tommy, Tommy was with me, I asked him what the jacks was in for ; he said the inside webs was turning.

Prof. KERRY.—And the jacks were put in to——

Mr. MCCUMBER.—The jacks was in there, I do not know what they were put in for, but that is what he told me.

Prof. KERRY.—Put in there to push them back straight in ?

Mr. MCCUMBER.—Yes.

Prof. KERRY.—Is that all you saw there ?

Mr. MCCUMBER.—Yes, and the holes was supposed to be all inch holes and there was some ⅞ bolts and ¾ to ⅞ in that joint. The reason the riveters gave is that they said they had bad hose.

Prof. KERRY.—Was the joint bulged ; were all the bolts in ?

Mr. MCCUMBER.—All the bolts were in, yes, except small bolts, ⅞ bolts.

Prof. KERRY.—What made you quit at 2 o'clock ?

Mr. MCCUMBER.—Well, I had a few words with the foreman and I quit.

Prof. KERRY.—You did not see any other bad points in the bridge?

Mr. MCCUMBER.—No, that is all I did see.

Prof. KERRY.—You did not see these other points that the men were talking about?

Mr. MCCUMBER.—No, I heard of them, but that is all. I paid no attention to look at that.

Prof. GALBRAITH.—Were all the splice plates in position ? I mean, were they all in position in the place where they ought to be, the side plates, the splice plates, you understand, were they all in the joint?

Mr. MCCUMBER.—Yes.

Prof. GALBRAITH.—Every one of them ?

Mr. MCCUMBER.—All except the bottom plate.

Prof. GALBRAITH.—Where was the bottom plate lying ?

Mr. MCCUMBER.—On the scaffold.

Prof. GALBRAITH.—How many plates were there, do you know, that were on?

Mr. MCCUMBER.—I do not know ; there was just that joint.

Prof. GALBRAITH.—I mean how many were there at that joint that were placed, that were ready to be bolted or riveted?

Mr. MCCUMBER.—How many ?

Prof. GALBRAITH.—Yes, how many plates?

Mr. MCCUMBER.—There was not any ready until we got the holes reamed.

Prof. GALBRAITH.—No, I do not mean that. I mean that were up there, put in position on the chord ; how many were on the chord, attached to it ? You say one was off ?

Mr. MCCUMBER.—Yes, the bottom plate was off.

Prof. GALBRAITH.—How many were on?

Mr. MCCUMBER.—There was not any on the bottom side.

Prof. GALBRAITH.—No, but how many plates were on?

Mr. MCCUMBER.—On the side?

Prof. GALBRAITH.—On the side plates, yes?

Mr. MCCUMBER.—Well there is on the outside and the inside too, on the outside the pillar and plate and on the inside there is the pillar and plate.

Prof. GALBRAITH.—On the outside there is a pillar and plate?

Mr. McCUMBER.—Yes.

Prof. GALBRAITH.—There were two plates and two pillars.

Mr. McCUMBER.—Yes.

Prof. GALBRAITH.—That is two plates?

Mr. McCUMBER.—Yes.

Prof. GALBRAITH.—Then, how about the inside pillars?

Mr. McCUMBER.—They were all on.

Prof. GALBRAITH.—And the top cover plate was on?

Mr. McCUMBER.—Oh yes, that was on.

Prof. GALBRAITH.—So that there was one off, lying on the scaffold?

Mr. McCUMBER.—Yes.

Prof. GALBRAITH.—The bottom cover plate?

Mr. McCUMBER.—Yes.

Prof. GALBRAITH.—Were there any rivets at all in those that were on?

Mr. McCUMBER.—Yes, the rest was all riveted except the joint, the inside and the outside and this bottom plate.

Prof. GALBRAITH.—The spliced plates were not riveted?

Mr. McCUMBER.—No, sir.

Prof. GALBRAITH.—Was the top cover plate riveted?

Mr. McCUMBER.—No, sir.

Prof. GALBRAITH.—How was it held?

Mr. McCUMBER.—The centre two rows were not riveted but the outside was.

Prof. GALBRAITH.—The two centre ribs were not riveted.

Mr. McCUMBER.—That is it.

Prof. GALBRAITH.—But the outside ribs, the spliced plates were riveted?

Mr. McCUMBER.—There are four holes in each plate; tne outside were riveted, but these two centre rows were not.

Prof. KERRY.—Is there anything else you can think of that will help us to find out where the trouble was?

Mr. McCUMBER.—No, that is all I know.

Witness discharged.

Ed. BRITTON, sworn.

Mr. HOLGATE.—Are you an employee of the Phœnix Bridge Company?

Mr. BRITTON.—Yes, electrician?

Mr. HOLGATE.—You are an electrician?

Mr. BRITTON.—Yes, sir.

Mr. HOLGATE.—Where are you employed?

Mr. BRITTON.—All over the bridge, in all parts of the storage yards, and both sides of the river, and all around the Phœnix work at all.

Mr. HOLGATE.—On the 29th of August were you working?

Mr. BRITTON.—No, sir, I had left the 29th of August for Belair sub-station, the storage yard, that morning.

Mr. HOLGATE.—Then you were not near the bridge at the time of the accident?

Mr. BRITTON.—No, sir, I was not there.

Mr. HOLGATE.—What information by way of particulars connected with the structure have you got?

Mr. BRITTON.—The structure itself I have none, only from hearsay. I heard them talking and I mentioned to the boys on Wednesday morning they were going to move out the traveller. I told some of the boys about it, and they called me and I told of this private talk I heard.

Mr. HOLGATE.—What private talk?

Mr. BRITTON.—I heard them talking in the office, Yenser and Birks and McLure,

and that is the first time I heard of it, Tuesday morning the 27th, Yenser came out and told me they would not move the traveller; I am always there at the time they move the traveller, right behind the traveller, and when they told me they would not move I left the office. I heard them talking about the bottom chords being bad, and Yenser said he did not care to do it because his life was in danger.

Mr. HOLGATE.—What did he say about the bottom chord?

Mr. BRITTON.—He said there seemed to be a buckle, a start to buckle, or something like that.

Mr. HOLGATE.—You may have a general idea in your mind about what took place but I want to know what you heard?

Mr. BRITTON.—I heard him say about this chord.

Mr. HOLGATE.—What chord?

Mr. BRITTON.—The second and third chord, I think over the pier, on the down stream side, the Quebec side, the second and third chords from the pier.

Mr. HOLGATE.—You overheard a conversation bearing on this? You say that Mr. McLure was there at the time?

Mr. BRITTON.—Yes.

Mr. HOLGATE.—Mr. McLure would be able to tell us what actually took place?

Mr. BRITTON.—Yes, sir.

Mr. HOLGATE.—If you can give us the definite points that this conversation referred to it would be useful.

Mr. BRITTON.—I can show you, of course, what chords I heard them referring to.

Mr. HOLGATE.—How did they refer to them?

Mr. BRITTON.—The second and third chord on the Quebec side over the pier on the cantilever arm.

Mr. HOLGATE.—That is on the cantilever arm?

Mr. BRITTON.—Yes, of course I did not look at it, or anything like that, I only heard what they said.

Mr. HOLGATE.—Did you hear the whole conversation?

Mr. BRITTON.—Not all of it. I went out after I heard a certain amount of it.

Mr. HOLGATE.—You did not hear the conclusion of it?

Mr. BRITTON.—I heard Mr. Birks refer to Yenser about a chord being bent in the yard.

Prof. GALBRAITH.—Bent?

Mr. BRITTON.—Bent while in the storage yard.

Prof. GALBRAITH.—Lying bent in the storage yard that day?

Mr. BRITTON.—The way I understood it, yes, sir.

Prof. GALBRAITH.—He was not saying that one of the chords which had been placed in the bridge had been bent in the yard?

Mr. BRITTON.—He said there was one chord had been bent, probably it was that one.

Prof. GALBRAITH.—Is that what he said, then you misunderstood my previous question.

Mr. BRITTON.—That is what he said; he said it might have been this one they had in the storage yard that was bent. Then they went on to talk about it, and he told them he would go up on the chord, and if it did not look straight——

Mr. HOLGATE—Are you recollecting this conversation as it took place?

Mr. BRITTON.—As it took place.

Mr. HOLGATE.—What was the upshot of this conversation?

Mr. BRITTON.—I cannot say what started it.

Mr. HOLGATE.—What was the end of it?

Mr. BRITTON.—Well, the last that I heard of it was that they were trying to tell Yenser that the chord might have been bent some before it was put in place. Yenser could not think that that would be possible because he said he had went over these chords different times. They went on talking and he said he did not care about moving

out the traveller again until they fully investigated. They kept on talking and I went outside. The next morning he told me they were not going to move the traveller, Wednesday morning. I went out on the traveller and told Cook and a couple of men asking them about it, if they heard it. I began to think it quite serious myself, after hearing them talk it over. I told these gentlemen and they seemed to go down that night and look at the chord I was alluding to.

Mr. HOLGATE.—This was what night?

Mr. BRITTON.—Wednesday night, it was Tuesday morning I heard the conversation.

Mr. HOLGATE.—Were you with them?

Mr. BRITTON.—No, sir, I did not go to see it at all.

Mr. HOLGATE.—How do you know they went down there?

Mr. BRITTON.—I just say they told me so—Mr. Haley—I could not say they went down for sure, only he told me. They told me they were going to go and look at it that day.

Mr. HOLGATE.—Of your own knowledge, have you information of or any knowledge of anything out of order?

Mr. BRITTON.—No, only what I heard them say.

Mr. HOLGATE.—And that arose first of all at this conversation you heard?

Mr. BRITTON.—Tuesday morning.

Mr. HOLGATE.—And you heard nothing before that?

Mr. BRITTON.—Nothing before that whatever.

Witness discharged.

THEODORE LACHAPELLE sworn.

Mr. HOLGATE.—Are you in the employ of the Phœnix Bridge Company?

Mr. LACHAPELLE.—Yes.

Mr. HOLGATE.—In what capacity, what do you do?

Mr. LACHAPELLE.—I am a bridge worker, I do everything.

Mr. HOLGATE.—What are you, an erector?

Mr. LACHAPELLE.—Yes, an erector.

Mr. HOLGATE.—How long have you been there on this Quebec bridge?

Mr. LACHAPELLE.—Well, that is this summer I have been there for six or seven weeks; I worked there before.

Mr. HOLGATE.—Were you working on the 29th day of August?

Mr. LACHAPELLE.—The 29th day of August?

Mr. HOLGATE.—The day the accident happened to the bridge?

Mr. LACHAPELLE.—No, I worked there until nine o'clock in the morning and then came over here to Quebec.

Mr. HOLGATE.—Why did you leave?

Mr .LACHAPELLE.—Well, I left on account of wind and I did not feel like working that day and I left.

Mr. HOLGATE.—Was it on account of wind or——

Mr. LACHAPELLE.—I did not feel like working so I thought I would come over here.

Mr. HOLGATE.—So it was not on account of wind?

Mr. LACHAPELLE.—Oh, yes, I was working on the top traveller.

Mr. HOLGATE.—How fast was the wind going that day?

Mr. LACHAPELLE.—I did not run against it and see how fast it was going.

Mr. HOLGATE.—Was it faster than other days?

Mr. LACHAPELLE.—No, but a man feels like work one day and he does not another day.

Mr. HOLGATE.—Then you did not see the accident?

Mr. LACHAPELLE.—No, I was not there when the accident happened.

Mr. HOLGATE.—Previously to the accident where were you working on the bridge?

Mr. LACHAPELLE.—Well, I was working on the big traveller.

Mr. HOLGATE.—And that was the last job you had?

Mr. LACHAPELLE.—Yes, taking down the big traveller.

Mr. HOLGATE.—Do you know from your own knowledge of anything defective or wrong existing in the structure?

Mr. LACHAPELLE.—No.

Mr. HOLGATE.—That you considered so?

Mr. LACHAPELLE.—Not that I know of. That bottom chord they talked about but I never went over to see, I never went over and looked at it, never anywheres near it. I worked on the bottom chord on this side between the two piers, but I did not work on the bottom chord on the outside pier.

Mr. HOLGATE.—Which bottom chord did you work on?

Mr. LACHAPELLE.—I worked on both of them, in the inside pier, between the two piers. Nothing I see was wrong and I worked around the pier, around the shoe there I worked there for about five or six days or more.

Mr. HOLGATE.—Could you say that as far as you saw the work was properly done?

Mr. LACHAPELLE.—Yes, as far as I could see, but of course you could not do it all in one day. If a little work was bad and you had some of them raising the iron and some others finishing up back of it fitting up and riveting and all that, the work was all right as far as I could find out, the part I seen.

Mr. HOLGATE.—And you traversed that bridge back and forward to the travellers several times a day?

Mr. LACHAPELLE.—Oh, yes, several times a day.

Mr. HOLGATE.—And of your own knowledge do I understand that you do not know of anything that was wrong?

Mr. LACHAPELLE.—No.

Mr. HOLGATE.—Have you worked about the shoe?

Mr. LACHAPELLE.—Yes.

Mr. HOLGATE.—What work were you doing there?

Mr. LACHAPELLE.—Well, I was reaming out holes and putting in bolts.

Mr. HOLGATE.—How long were you there?

Mr. LACHAPELLE.—Straightening up angles, where we had the chain around to raise up the iron and a flange would bend or anything, we would straighten that up to look better, that is all.

Mr. HOLGATE.—How long were you there?

Mr. LACHAPELLE.—About three or four days in that place.

Mr. HOLGATE.—Did you observe anything wrong at that particular place?

Mr. LACHAPELLE.—Not that I saw.

Mr. HOLGATE.—No broken plates or angles?

Mr. LACHAPELLE.—I saw no broken plates or angles. I saw some angles that were bent but we go to work and straighten them and get them back with a couple of mauls.

Mr. HOLGATE.—How long have you been a bridgeman?

Mr. LACHAPELLE.—For the last five years.

Mr. HOLGATE.—Constantly on bridge work?

Mr. LACHAPELLE.—Yes.

Mr. HOLGATE.—If you had been in that vicinity for three or four days is it probable that you would have seen if there was anything wrong there from your general observation?

Mr. LACHAPELLE.—I did not run around the shoe on purpose to look and see if anything was wrong. I was sent to a certain point at that time to clean up, cleaning out the holes and putting bolts in. Of course, I walked around there but I never took a special day to go and see if there was anything wrong. I never saw anything wrong there.

Mr. HOLGATE.—Have you heard it stated that there was a plate cracked there?

Mr. LACHAPELLE.—I heard that there was a plate cracked there only after the bridge was down. I never heard it before.

Mr. HOLGATE.—Your opinion is, from your inspection, that probably someone has made a mistake about that?

Mr. LACHAPELLE.—I don't know.

Prof. KERRY.—You saw that plate pretty often?

Mr. LACHAPELLE.—Yes, I went over this plate pretty often. I was there when we put the shoe on two years ago and I was there last year and this year but I never saw any plate cracked there. I have been on this job three seasons and I never saw a plate cracked.

Mr. HOLGATE.—Are you quite clear about the plate I mean and to which I referred just now?

Mr. LACHAPELLE.—No, I am not,—whether it was the plate around the shoe. I was around that shoe and I saw no plate cracked. If there was a plate cracked there I never saw it. It is probably another plate I have seen. There are a good many plates around there.

Mr. HOLGATE.—Were any of the plates shaped or crimped?

Mr. LACHAPELLE.—No, there was a plate there that was cracked but it was made to be cracked.

Witness discharged.

Commission adjourned until 10 a.m. to-morrow (Saturday).

SIXTH DAY.

QUEBEC, Saturday, September 14, 1907.

The Commission resumed at 10 a.m.

Mr. PETER FRENCH, was sworn as interpreter.

DESIRE LEFEBVRE, sworn.

Mr. HOLGATE.—Are you employed by the Phœnix Bridge Company?

Mr. LEFEBVRE.—Yes, sir.

Mr. HOLGATE.—How long have you been with that company?

Mr. LEFEBVRE.—About four years.

Mr. HOLGATE.—What portion of that time were you working on the Quebec bridge?

Mr. LEFEBVRE.—I worked there during the whole four years every summer at the bridge.

Mr. HOLGATE.—What were your duties?

Mr. LEFEBVRE.—I worked for one summer on the ground work with the bull gang, and for the last three summers I have been running the crane.

Mr. HOLGATE.—Where?

Mr. LEFEBVRE.—In the storage yard.

Mr. HOLGATE.—Did your duties necessitate in any way your going on the bridge structure during its erection?

Mr. LEFEBVRE.—No, sir.

Mr. HOLGATE.—In connection with your duties in the storage yard, what had you to do?

Mr. LEFEBVRE.—In the storage yard I unloaded cars that came from the shop.

Mr. HOLGATE.—What do you mean by the shop?

Mr. LEFEBVRE.—The iron sent from the shops from the Phœnix Bridge Company. I do not know where the shops were. I mean the iron sent from the shop of the Phœnix Bridge Company. I mean iron brought by train or out of the Phœnix Bridge Company's shops.

Mr. HOLGATE.—Were you foreman of the gang?

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—What was the name of the foreman?

Mr. LEFEBVRE.—I do not know his first name. His name is Clark.

Mr. HOLGATE.—In handling all that material from the cars after it arrived from Phœnixville, could you say that it was all carefully handled?

Mr. LEFEBVRE.—I do not know much about it, but everything seemed correct.

Mr. HOLGATE.—Have you knowledge of any accident happening in the handling of that material in the storage yard?

Mr. LEFEBVRE.—No, if any accident happened I did not know it.

Mr. HOLGATE.—If any accident of that nature did happen who would be likely to know it?

Mr. LEFEBVRE.—I could not say. Mr. Clark would have information because he was the foreman there the whole time.

Mr. HOLGATE.—Have you heard from others that any accident of that nature did take place, like the breaking of a piece out of the tackle?

Mr. LEFEBVRE.—Yes, I did.

Mr. HOLGATE.—From whom did you hear that?

Mr. LEFEBVRE.—From Mr. Roberge.

Mr. STUART.—What is his Christian name?

Mr. LEFEBVRE.—Malcolm.

Mr. HOLGATE.—Were you ever on the bridge structure?

Mr. LEFEBVRE.—Yes, sir, I was there this spring on the track. I was there working about four days this spring.

Mr. HOLGATE.—Whereabouts on the bridge were you working?

Mr. LEFEBVRE.—On the end, in the middle and on the ground. I was not everywhere around on top but I was on the track.

Mr. HOLGATE.—Were you below the track?

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—Were you there more than four days?

Mr. LEFEBVRE.—I worked on the beach the other part of the time outside of these four days. I worked for about eight days, four days on top and four days below the bridge.

Mr. HOLGATE.—During that time and any other time that you may have been on the bridge was anything particular drawn to your attention?

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—Then you know nothing personally in regard to the structure?

Mr. LEFEBVRE.—I heard something.

Mr. HOLGATE.—Do you of your own knowledge.

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—Have you any knowledge and what is the nature of it in regard to anything of a defective nature?

Mr. LEFEBVRE.—The only knowledge I have is what I have been told by people about it.

Mr. HOLGATE.—Who gave you that information?

Mr. LEFEBVRE.—I got it from an Indian who is dead.

Mr. HOLGATE.—From anybody else?

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—What was the nature of the information you got?

Mr. LEFEBVRE.—I was told that there was a piece of iron that had been forced. That is the way the Indian told me.

Mr. HOLGATE.—What was the Indian's name?

Mr. LEFEBVRE.—Angus Blue. That is the name he went by; I am not sure that it is his right name.

Mr. HOLGATE.—He is one of those who lost his life?

Mr. LEFEBVRE.—Yes, sir, he got killed in the accident.

Mr. HOLGATE.—Was the information given you by him sufficient to enable you to understand exactly what was meant?

Mr. LEFEBVRE.—Yes.

Mr. HOLGATE.—Will you tell us exactly what he told you?

Mr. LEFEBVRE.—He told me that there was a large chord on the Quebec side which was strained.

Prof. GALBRAITH.—Does 'forced' mean that it was a little out of shape?

Mr. LEFEBVRE.—The Indian did not tell me exactly what he meant by the word.

Mr. HOLGATE.—Was it on the bridge he told you this ?

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—Did he mention it more than once?

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—When was it that he told you this ?

Mr. LEFEBVRE.—I cannot say precisely at what date, but about four weeks ago.

Mr. HOLGATE.—Anybody else mention this matter to you?

Mr. LEFEBVRE.—No.

Mr. HOLGATE.—Is that the only thing that you heard from any source ?

Mr. LEFEBVRE.—Yes.

Mr. HOLGATE.—You said that it was a chord on the Quebec side. Was it an upper chord or a lower chord ?

Mr. LEFEBVRE.—The lower chord.

Mr. HOLGATE.—Was it in the anchor arm or the cantilever arm ?

Mr. LEFEBVRE.—He did not tell me.

Witness discharged.

E. L. EDWARDS sworn.

Mr. HOLGATE.—What is your official position ?

Mr. EDWARDS.—Inspector of materials at mills and shops for the Quebec Bridge and Railway Company.

Mr. HOLGATE.—Are your duties entirely connected with the Quebec Bridge and Railway Company—confined to the inspection of work and material for the Quebec Bridge and Railway Company ?

Mr. EDWARDS.—There was one occasion on which I did a little work while there was practically nothing being done for the Quebec bridge and Railway Company.

Mr. HOLGATE.—When were you appointed?

Mr. EDWARDS.—In May, 1904.

Mr. HOLGATE.—By whom were you appointed ?

Mr. EDWARDS.—By Theodore Cooper with the consent of Mr. Hoare.

Mr. HOLGATE.—To whom were you responsible ?

Mr. EDWARDS.—To both Mr. Cooper and Mr. Hoare.

Mr. HOLGATE.—From whom did you receive instructions ?

Mr. EDWARDS.—From both.

Mr. HOLGATE.—By whom were you paid ?

Mr. EDWARDS.—By the Quebec Bridge and Railway Company.

Mr. HOLGATE.—Have you written instructions relating to your appointment and defining your duties?

Mr. EDWARDS.—I have written instructions in regard to my appointment, but no written instructions in regard to my duties that I recollect now. They were given verbally.

Mr. HOLGATE.—What is your understanding of your instructions?

Mr. EDWARDS.—My instructions were from Mr. Cooper, first that we should use unusual care, that this was a bridge of great magnitude and that we should do everything in our power to get the very best materials and workmanship, and the understanding was that if my services were not satisfactory they would be dispensed with.

Mr. HOLGATE.—Did Mr. Cooper or Mr. Hoare furnish you with a specification of the material and the workmanship required?

Mr. EDWARDS.—No, sir.

Mr. HOLGATE.—Then, what was the standard that you adopted in your inspection of the material and the workmanship?

Mr. EDWARDS.—The Quebec Bridge Company's specifications, Mr. Theodore Cooper's specifications of 1904, and also we made certain special tests outside of these that were not covered by any of these specifications.

Mr. HOLGATE.—Who furnished you with these specifications?

Mr. EDWARDS.—I secured them at the office of the Phœnix Bridge Company.

Mr. HOLGATE—Were they approved by Mr. Cooper or Mr. Hoare?

Mr. EDWARDS.—No, sir.

Mr. HOLGATE.—Do we understand, Mr. Edwards, that the specifications that you worked under as to the standard of material and workmanship were those that you received from the Phœnix Bridge Company, the contractors only?

Mr. EDWARDS.—Also in case of doubt as to any material it was to be referred to Mr. Cooper's judgment, which I did on several occasions.

Mr. HOLGATE.—In those cases what course was followed?

Mr. EDWARDS.—Mr. Cooper told me how to proceed.

Mr. HOLGATE.—Did he prescribe special tests in those cases?

Mr. EDWARDS.—He did in some cases, but he told me that he would be guided by the circumstances in each case.

Mr. HOLGATE.—Were special tests made?

Mr. EDWARDS.—Special tests were made; yes, sir. Mr. Cooper incorporated some of them in an article written by Mr. Cooper and read before the American Society of Civil Engineers under the title of 'Some new facts about eye-bars.'

Mr. HOLGATE.—These special tests were made at your immediate instance?

Mr. EDWARDS.—At Mr. Cooper's instance.

Mr. HOLGATE.—Are these the tests you referred to just now as being made specially by the Phoenix Bridge Company?

Mr. EDWARDS.—There is additional information. These tests were made in part but there is also additional information which is not covered by my reports.

Mr. HOLGATE.—Where were these tests made?

Mr. EDWARDS.—Made at the works of the Phoenix Iron Company.

Mr. HOLGATE.—All of them?

Mr. EDWARDS.—Yes, sir.

Mr. HOLGATE.—These are the special tests? Were there any tests anywhere else of material?

Mr. EDWARDS.—Outside of the usual tests?

Mr. HOLGATE.—Yes.

Mr. EDWARDS.—No other tests were made that I recall.

Mr. HOLGATE.—Was all the testing done at the Phoenix Iron Company's works?

Mr. EDWARDS.—No, sir, the test of plates were made at the Central Iron and Steel Company, specimen tests of plates were made at the Carnegie Steel Company, and tests of sizes at the Bethlehem Steel Company.

Mr. HOLGATE.—Were you present at these tests?

Mr. EDWARDS.—No, at Harrisburg Mr. Keenan performed all these tests and the tests were performed on the Carnegie material by John N. Ostrom.

Mr. HOLGATE.—Was the result of these tests recorded?

Mr. EDWARDS.—The result of these tests was recorded.

Mr. HOLGATE.—Have you the records?

Mr. EDWARDS.—The records are here. They have been submitted.

Mr. HOLGATE.—Are they included in the reports that Mr. Hoare has put in in regard to the inspection?

Mr. EDWARDS.—Yes, sir.

Mr. HOLGATE.—You had a systematic form of reporting all tests and inspections?

Mr. EDWARDS.—Yes, sir, regular forms for reporting each class of test.

Mr. HOLGATE.—How often did you report?

Mr. EDWARDS.—I made a monthly report on the shop work and besides that about every month or two I would send in a batch of tests to Mr. Hoare covering the material which had been inspected in the meantime since the last report.

Mr. HOLGATE.—I think you said that you sent these reports also to Mr. Cooper?

Mr. EDWARDS.—The tests of full sized eye-bars were sent to both Mr. Cooper and Mr. Hoare and the specimen tests of material were sent to Mr. Hoare only. Mr. Cooper received these except in such cases as he asked for them. He asked for them on the eye-bars.

Mr. HOLGATE.—Was the inspection in regard to workmanship reported to Mr. Cooper and Mr. Hoare?

Mr. EDWARDS.—It was reported to Mr. Hoare in monthly reports and verbally to Mr. Cooper on the occasion of my visits to him. I saw him monthly.

Mr. HOLGATE.—There were no written reports to Mr. Cooper?

Mr. EDWARDS.—No, nothing of any account.

Mr. HOLGATE.—Was there anything of a very special nature that arose in regard to the material that was used?

Mr. EDWARDS.—Nothing of account—no, sir.

Mr. HOLGATE.—Who decided the form of the report, Mr. Edwards, that you sent in?

Mr. EDWARDS.—The form of the report was really gotten up by me, subject to Mr. Cooper, and I could not say whether he submitted it to Mr. Hoare or not; but I am inclined to think he did and it was returned to me with Mr. Cooper's approval.

Mr. HOLGATE.—Was the report form changed in any way during the progress of the work?

Mr. EDWARDS.—No, sir.

Mr. HOLGATE.—So then the reports will show a continuous uniform system of keeping records from the first starting of the work at the shop up to the present time?

Mr. EDWARDS.—Yes, sir.

Mr. HOLGATE.—In connection with the testing of materials, Mr. Edwards, what experience have you had?

Mr. EDWARDS.—I had, previous to my connection with this work, an experience of seventeen years.

Mr. HOLGATE.—You might just give us some details of that?

Mr. EDWARDS.—Well, for a year or a year and a half, I have forgotten the exact time, I was connected with the Pottsville Iron and Steel Company in their testing department and also in their mills in another capacity. After that, I went out with William R. Webster as inspector. I remained for two years there, after which I was connected with G. W. G. Ferris and Company for about the same time, with Booth, Garrett & Blair for four or five years and was manager for Robert W. Hunt & Co., in their Philadelphia district for six years.

Mr. HOLGATE.—Did that work embrace a quantity of material used in the construction of bridges?

Mr. EDWARDS.—For the most part bridges and building work.

Mr. HOLGATE.—Did that experience embrace the processes of manufacture of the material?

Mr. EDWARDS.—It did.

Mr. HOLGATE.—And of the testing of it?

Mr. EDWARDS.—Yes, sir.

Mr. HOLGATE.—Did you represent in these cases the iron company or the purchasers?

Mr. EDWARDS.—The purchasers with that one exception, that time I was with the Pottsville Iron and Steel Company.

Prof. GALBRAITH.—You have knowledge of the relation of the chemical analysis of the materials and products, and also of the later microscopical examination to the properties required in material.

Mr. EDWARDS.—I have a knowledge of the chemical properties; the microscopical we do not deal so much with.

Mr. HOLGATE.—In the course of your inspection of the material for this particular work, Mr. Edwards, what proportion, roughly speaking, were you obliged to reject?

Mr. EDWARDS.—Very little.

Mr. HOLGATE.—I am speaking now only of the material?

Mr. EDWARDS.—Of the material.

Mr. HOLGATE.—Not yet fabricated?

Mr. EDWARDS.—Very little indeed, for the reason that the mills for the most part attempted to throw out the material before it came to us.

Mr. HOLGATE.—That is before they submitted the material to you for inspection, they made themselves reasonably sure that it would pass your inspection?

Mr. EDWARDS.—Yes, sir, realizing the importance of the work. For instance the Central Iron and Steel Company showed me one time I was there, a huge pile of eye-bar material that they had rejected. I had not gone over it, it had never been submitted to our men at all. Anything they thought he would reject they did not put before him.

Mr. HOLGATE.—Well, what value do you place upon that action?

Mr. EDWARDS.—Well, it simply saved them the labour of handling that material; they turned it into scrap before they handled it in their different departments.

Mr. HOLGATE.—Then of the material that was actually submitted to you for inspection, what percentage were you obliged to reject?

Mr. EDWARDS.—Oh, I should say not over 2½ per cent of the material submitted was rejected.

Mr. HOLGATE.—Well, will the reports show the rejections?

Mr. EDWARDS.—No, they will not; the reports will not show all the material rejected.

Mr. HOLGATE.—Do the reports note the rejection of material at all?

Mr. EDWARDS.—Yes, sir.

Mr. HOLGATE.—Is there any information that you can give us with regard to material that is not contained in the reports?

Mr. EDWARDS.—None whatever.

Mr. HOLGATE.—And the file of reports is complete?

Mr. EDWARDS.—The reports are complete; yes, sir.

Prof. GALBRAITH.—You knew the exact nature of the material which was furnished to the shop; you know its history, where it was made and the process by which it was made and the necessary composition of the material?

Mr. EDWARDS.—Yes, sir, we have complete records of all the material and by whom every piece was rolled.

Prof. GALBRAITH.—Did you ever examine in the rolling mill the cropping of the ingots?

Mr. EDWARDS.—No, sir.

Mr. HOLGATE.—Now, with regard to the fabrication of the material, Mr. Edwards, have you a copy of the specifications you worked under?

Mr. EDWARDS.—Have I that with me?

Mr. HOLGATE.—Yes?

Mr. EDWARDS.—No, sir, I have not.

Mr. HOLGATE.—You can furnish us with that?

Mr. EDWARDS.—Yes, sir.

Mr. HOLGATE.—Did you inspect the fabrication?

Mr. EDWARDS.—The fabrication was inspected, I had charge of that with Mr. Meeser as my assistant and Mr. McLure certain months of the year as assistant when he was not up here on erection.

Mr. HOLGATE.—Was that inspection a continuous one at the shop?

Mr. EDWARDS—Yes, sir, it was.

Mr. HOLGATE.—And how was your inspection noted on the completed members? Was it marked on the completed members, is there a record on the member itself?

Mr. EDWARDS.—On the member itself there is a large 'Q' in yellow paint, and inside is stamped 'Q-B', showing that the material is accepted.

Prof. GALBRAITH.—That is, there were two 'Q's', a large 'Q' and inside a stamp 'Q-B.'

Mr. EDWARDS.—Yes.

Prof. GALBRAITH.—One painted on, the other stamped?

Mr. EDWARDS.—Yes, that is it. That was not done on the eye-bars, we never placed those stamps on there, they had enough marks on as it was.

Prof. GALBRAITH.—And how did you mark rejected members?

Mr. EDWARDS.—They were not marked at all.

Prof. GALBRAITH.—Were there any members rejected?

Mr. EDWARDS.—When I said they were not marked at all, I had reference to the piece that was rejected and sent back. Yes, there was, well not exactly rejected, but we refused to take some pieces and then they would be returned. In one case I remember a post that was crooked, that was returned, the rivets were all knocked out, the piece restraightened, and then brought before us again.

Prof. GALBRAITH.—Returned from where?

Mr. EDWARDS.—Returned from the finishing department back to the assembling department.

Prof. GALBRAITH.—That particular piece then was made right and again inspected?

Mr. EDWARDS.—Yes, sir, made right and again inspected and accepted.

Prof. GALBRAITH.—And shipped?

Mr. EDWARDS.—And shipped.

Prof. GALBRAITH.—Was any material returned to you from Quebec?

Mr. EDWARDS.—None whatever.

Prof. GALBRAITH.—Did you hear at any time any complaints from the Quebec end of material arriving that was not perfect?

Mr. EDWARDS.—The only one I recall now was with respect to painting, that was the greatest trouble we had from the field, they claimed there were spots that were not painted.

Prof. GALBRAITH.—Was there an instance of complaint arising from any structural feature?

Mr. EDWARDS.—On the anchor arm there was one complaint in regard to a truss floor beam that the holes did not come exactly right, that is the only one I remember on the whole anchor arm; and on the cantilever arm, when they went to put in the end posts, there were some plates there that did not exactly gee, and they had to chip off about half an inch there, after which they went into place. These are the only two things I recall now of any complaints in regard to workmanship.

Prof. KERRY.—What method had you to ensure that only inspected material was shipped?

Mr. EDWARDS.—The material at the mills was stamped as well as the finished material and besides that the inspector reported to me continually. There was nothing that had gone on the cars without he received copies of the invoice; he knew exactly what was shipped on each car, and if anything was put on there which was defective, which he had not passed, he would advise me.

Prof. KERRY.—That is to say each shipment was systematically checked?

Mr. EDWARDS.—Each shipment, and copies of these shipments were sent to me.

Prof. KERRY.—You knew from the invoice that the material had been inspected?

Mr. EDWARDS.—I knew that or I would not accept it, and there were the reports I later received from the inspector.

Mr. HOLGATE.—Will your reports show any details as to how the final inspection was made before putting your mark on it?

Mr. EDWARDS.—No, sir, the reports will not show that; the monthly reports will simply show what progress is made in the shop during the month and about what the state of affairs was in order to keep Mr. Hoare advised regarding what they were doing. They do not show anything in regard to the quality.

Prof. KERRY.—Nothing in regard to quality?

Mr. EDWARDS.—I mean as regards the shop inspection, the monthly reports from the shop I referred to.

Mr. HOLGATE.—Simply the fabrication reports?

Mr. EDWARDS.—Simply the fabrication reports.

Mr. HOLGATE.—They referred more to the progress of the work and what was being done in the way of shipping?

Mr. EDWARDS.—Yes, sir.

Prof. KERRY.—The monthly reports will show fully the quality of the material?

Mr. EDWARDS.—Fully, yes, sir.

Prof. GALBRAITH.—Did you test and report on the plate of which the bridge pieces were built up as well as the riveted up pieces?

Mr. EDWARDS.—Yes, sir, the reports of all plates have been submitted, the reports of tests on these plates.

Prof. GALBRAITH.—Did you check the templets as well as the completed work, Mr. Edwards?

Mr. EDWARDS.—No, sir, we did not check templets. We checked tapes and we rejected a number; we refused to allow them to be used before they were absolutely correct with the standard.

Prof. GALBRAITH.—That is, you rejected a number of tapes?

Mr. EDWARDS.—Yes, sir.

Prof. GALBRAITH.—Were these steel tapes?

Mr. EDWARDS.—Yes, sir, George Eddy's steel tapes.

Mr. HOLGATE.—Were the members tested by yourself for straightness and general condition before they were loaded on the cars?

Mr. EDWARDS.—Yes, sir, they were inspected by us for these conditions.

Mr. HOLGATE.—And what was the process after they left your hands?

Mr. EDWARDS.—After they left our hands they were put into the hands of the shipper and loaded on cars and they were usually given another inspection on the cars, a general inspection, not in detail.

Mr. HOLGATE.—A general inspection simply to ascertain that the loading had been done in a proper way?

Mr. EDWARDS.—Well, we did not inspect the loading probably as much as we did to see that they were properly painted and that there was nothing that had escaped us in the shop.

Mr. HOLGATE.—What can you say about the methods that were used in loading with reference to the safe carrying of the members?

Mr. EDWARDS.—Unusual precautions were taken in that way. Drawings had been furnished by the Phœnix Bridge Company to their shipper and he was supposed to follow those implicity, and besides that the railway companies had not only their inspectors, but had men in higher authority there to watch the loading before they allowed the cars to leave the works.

Mr. HOLGATE.—Do I understand that the Phœnix Bridge Company had a plan showing how the members should be loaded on the cars?

Mr. EDWARDS.—For the larger and heavier members.

Prof. GALBRAITH.—You mean apparently that only pieces of a definite specified kind could be loaded on one car?

Mr. EDWARDS.—Well, usually it would take more than one car, the pieces were so heavy.

Prof. GALBRAITH.—On one or more cars?

Mr. EDWARDS.—On one or more cars, and where they were unusually heavy or long these special instructions were issued.

Mr. HOLGATE.—I think you told us, Mr. Edwards, that the specifications you worked under you received from the Phœnix Bridge Company, but did you not get some specifications from Mr. Hoare direct?

Mr. EDWARDS.—I have no recollection of any.

Mr. HOLGATE.—But from time to time you received instructions from both Mr. Cooper and Mr. Hoare with regard to the standard of the inspection?

Mr. EDWARDS.—Yes, sir, I did from both Mr. Cooper and Mr. Hoare.

Mr. HOLGATE.—And were they written or verbal?

Mr. EDWARDS.—Verbal for the most part, I think.

Mr. HOLGATE.—And the result of the whole was carried out in the final inspection of the materials?

Mr. EDWARDS.—Yes, sir.

Mr. HOLGATE.—Were these amended instructions received after the manufacture of the material was commenced?

Mr. EDWARDS.—Yes, sir.

Mr. HOLGATE.—At what period then were any amended instructions given?

Mr. EDWARDS.—Well, about—I do not recollect the exact time, but about six or seven months after we started on the work there was a change made in the specifications of the eye-bars.

Mr. HOLGATE.—Did it only affect eye-bars?

Mr. EDWARDS.—I think it did.

Mr. HOLGATE.—Have you notes of what these changes were?

Mr. EDWARDS.—You mean have I written instructions with regard to them? I know exactly what they were; instead of having a low limit of 60,000 pounds per square inch the low limit was changed to 62,000 pounds.

Mr. HOLGATE.—I understand these instructions were verbal?

Mr. EDWARDS.—I think they were.

Mr. HOLGATE.—Were these reports all signed by you, Mr. Edwards?

Mr. EDWARDS.—I think Mr. Meeser's name is on some of them, although I made them all up.

Mr. HOLGATE.—Then Mr. Meeser did sign some?

Mr. EDWARDS.—He did not sign the reports that were sent to Mr. Hoare, he signed the reports that were sent to me, and then I would recopy them and send them on.

Prof. GALBRAITH.—With your signature?

Mr. EDWARDS.—With my signature, and in some cases in the early part of the work, I think I left his signature; I put his signature to them; his signature is on some although they were written by me.

Mr. HOLGATE.—That is to say, they were actually signed by him or did you write his name?

Mr. EDWARDS.—I wrote his name.

Mr. HOLGATE.—And wrote 'signed.'

Mr. EDWARDS.—I think my initials are to them.

Witness retired.

IRVIN W. MEESER, sworn.

Mr. HOLGATE.—What are you?

Mr. MEESER.—Inspector for the Quebec Bridge and Railway Company.

Mr. HOLGATE.—At Phœnixville?

Mr. MEESER.—Phœnixville.

Mr. HOLGATE.—And your duties comprise?

Mr. MEESER.—Comprise seeing that the work is made like the drawings, that the workmanship is all right, that the rivets are tight, that the whole thing is made as per drawings.

Mr. HOLGATE.—Who appointed you?

Mr. MEESER.—Mr. Edwards.

Mr. HOLGATE.—And to whom do you report?

Mr. MEESER.—Mr. Edwards.

Mr. HOLGATE.—Were your duties confined to the fabrication?

Mr. MEESER.—Yes, sir.

Mr. HOLGATE.—And what generally were your methods of checking?

Mr. MEESER.—Well, in using our tape line, our long measurements, we had a tape line that had been examined by the master tape used by the shop, all tapes were regulated by that, and we had an appliance put on the line at the foot mark, and we used a 4-foot steel scale to set it by, and that was held on by a man, one of the assistants in the bridge company's employ, and the chief inspector and myself would read it. On the other end we had an appliance made with a scales on and we always pulled a certain number of pounds, which was carried out from one end to another in all departments; we all pulled 10 pounds, and he would read it while I would pull it, and I would read it while he would pull it, and after we both read it, we would both go up and tell one another what we made it. We never told each other until we both made measurements. If it was necessary in measuring, he could call any number of men to hold it in line, he had that permission.

Mr. HOLGATE.—Were errors discovered?

Mr. MEESER.—Yes, sir.

Mr. HOLGATE.—How were they corrected?

Mr. MEESER.—They were corrected in some cases by the pieces that were connected to them being made to suit that member.

Mr. HOLGATE.—The member then would not be altered itself, but the joining members would be corrected?

Mr. MEESER.—In some cases it was, in some cases not.

Mr. HOLGATE.—The drawings that were furnished to you, were they found to work out in the fabrication?

Mr. MEESER.—Yes, sir.

Mr. HOLGATE.—Did matters arise in the shop where the drawings erred?

Mr. MEESER.—I cannot recollect that there was any.

Mr. HOLGATE.—What we want to know is whether the drawings that were furnished to the shop, and which you inspected by, were correct drawings for the purpose?

Mr. MEESER.—Yes, sir.

Mr. HOLGATE.—Well considered?

Mr. MEESER.—Well considered.

Mr. HOLGATE.—During the fabrication of the material, were the appliances of the Phœnix Bridge Company's shop ample for the handling of all the parts?

Mr. MEESER.—I think the best.

Mr. HOLGATE.—The best that you know of?

Mr. MEESER.—That I have ever seen, yes, sir.

Mr. HOLGATE.—Are you generally familiar with plans of that nature?

Mr. MEESER.—I had been travelling from one plant to the other before I went with these people.

Mr. HOLGATE.—Then in the using of these appliances what care was used?

Mr. MEESER.—Well, all care was taken that nothing could be hurt in any way, shape or form. When they put the chains around they made all kinds of supports between the irons so they could not bend or buckle, and I think all the way through every care was exercised so that the pieces would not be injured in any way.

Mr. HOLGATE.—Was there any injury to any piece that took place in the shops?

Mr. MEESER.—There was one.

Mr. HOLGATE.—One? Have you any recollection of that?

Mr. MEESER.—I do.

Mr. HOLGATE.—Can you specify?

Mr. MESSER.—Well, they were carrying a chord across the yard and it fell, the chain broke, or if the chain did not break the teeth failed and it fell down.

Mr. HOLGATE.—Have you a record to show what part that was?

Mr. MEESER.—It was chord 10 of 622 on the north side, now in the Belair yard.

Mr. HOLGATE.—Now in the Belair yard?

Mr. MEESER.—Yes, sir.

Mr. HOLGATE.—Was it damaged to any extent?

Mr. MEESER.—It was bent, there was nothing broken about it, it was bent.

Mr. HOLGATE.—And what did you do when that occurred?

Mr. MEESER.—I called Mr. Edwards; he came up and looked at it, and took it up I think with his superior.

Prof. GALBRAITH.—What does that No. 622 mean?

Mr. MEESER.—622, it is the order. That is the way we have, all even numbers are on one side and all the odd numbers on the opposite side. 621 is in the side now that has fallen, the cantilever arm; No. 622 will be on the opposite side of the river. That is the Bridge Company's order, and that is the way we could tell.

Mr. GALBRAITH.—What was done with regard to that chord piece itself, Mr. Meeser?

Mr. MEESER.—It was straightened.

Prof. GALBRAITH.—And afterwards inspected by you?

Mr. MEESER.—Yes, sir.

Prof. GALBRAITH.—And found satisfactory?

Mr. MEESER.—Yes, sir.

Mr. GALBRAITH.—Did you immediately supervise the shipping or loading?

Mr. MEESER.—Not until it was thoroughly inspected by all parties concerned.

Prof. GALBRAITH.—But the actual loading on the cars, would you see the material after it was loaded on the cars?

Mr. MEESER.—Not in all cases, but I tried to make it a point to do so whenever I possibly could.

Prof. GALBRAITH.—Mr. Edwards has told us about the system used in connection with the loading of cars?

Mr. MEESER.—Yes, sir.

Prof. GALBRAITH.—Can you give us any further explanation of that?

Mr. MEESER.—On each piece of any size there was a drawing made giving full instructions to the chief shipper how it was to be loaded. With smaller members he used his own judgment.

Prof. GALBRAITH.—And what can you say as to the carrying out of those directions?

Mr. MEESER.—I think they were lived up to to the letter. The railway companies had their inspectors on the ground all the time, the cars were thoroughly gone over and if any question came up between the Bridge Company's representatives or the chief shipper and the inspectors, they sent for their chief inspectors, who were very often on the ground to make matters satisfactory to both parties before a car would leave the plant.

Prof. GALBRAITH.—Now with regard to the process of manufacture in the shop,

generally speaking, how was the work done? Did you have any difficulty in forcing your ideas of the specifications, in having the matter carried out?

Mr. MEESER.—I had not.

Prof. GALBRAITH.—With regard to the assembling and riveting how did you find the work complying with your wishes?

Mr. MEESER.—Good.

Prof. GALBRAITH.—Sufficiently good to warrant your accepting it when it was completed?

Mr. MEESER.—Yes, sir, extreme care was taken on this.

Prof. GALBRAITH.—In what way?

Mr. MEESER.—Every way, all the way through, in all parts, all departments. They had all received special instructions to make this, I might say a master job. Outside inspectors had come there and said they had received better results since our own job was started on their own work.

Prof. GALBRAITH.—And these reports that Mr. Edwards refers to, you had knowledge of so far as the fabrication is concerned?

Mr. MEESER.—The reports I had nothing to do with.

Prof. GALBRAITH.—Was there any flanging or hot work, blacksmith work necessary in any part of the fabrication?

Mr. MEESER.—In some, yes, sir.

Prof. GALBRAITH.—What care was taken with respect to plates on which that work was done, after the flanging or other operation, with respect to cooling I mean?

Mr. MEESER.—They were let lie right down on the ground after they were finished, not on the ground but on beams that were there. They were let lie there until perfectly cool; we would not allow them to make them too hot.

Prof. GALBRAITH.—Care was taken about the temperature to which they were heated?

Mr. MEESER.—Yes, sir.

Prof. GALBRAITH.—What about winter work? Were any precautions taken to prevent them from being cooled too suddenly in the winter? Were any pieces thrown down into the snow?

Mr. MEESER.—Not that I know of; it is all under the roof where this is done.

Prof. GALBRAITH.—Or were they exposed to rain or wet while cooling.

Mr. MEESER.—No, it is all under roof.

The witness retired.

HORACE M. CLARK, sworn.

Mr. HOLGATE.—Mr. Clark, are you an employee of the Phœnix Bridge company?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—Are you connected with the work at the Quebec bridge?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—In what capacity?

Mr. CLARK.—Foreman in charge of the storage yard.

Mr. HOLGATE.—How long have you been acting in that capacity?

Mr. CLARK.—Since October 26, 1904.

Mr. HOLGATE.—Your duties confined you to the storage yard?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—Now, with regard to your duties, what do they cover?

Mr. CLARK.—They cover the unloading, the reception of the metal, the unloading, checking and storing it away and sending it to the bridge.

Mr. HOLGATE.—That is reloading.

Mr. CLARK.—Yes, sir, reloading and sending it to the bridge as it was required for daily erection.

Mr. HOLGATE.—And in doing that you would have to handle all these parts twice?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—What were your facilities for handling?

Mr. CLARK.—We had two electric cranes of 75 tons capacity each.

Mr. HOLGATE.—What was the weight of your heaviest piece handled?

Mr. CLARK.—The heaviest piece handled was about 98 tons, No. 10 chord section in the cantilever arm.

Mr. HOLGATE.—When you speak of checking, does that refer to checking quantities or dimensions.

Mr. CLARK.—It refers to taking the amount of material that comes in on the different cars to check them to see that they check with the invoice from the shipper?

Mr. HOLGATE.—It refers in no way to checking the dimensions of the parts?

Mr. CLARK.—No, sir, it just refers to the marks, the shipping marks and marks in connection with erection.

Mr. HOLGATE.—In handling the heavy parts were you always able to do it successfully or had you any trouble?

Mr. CLARK.—Well, we never had any trouble, except with one chord section that we had a misfortune with.

Mr. HOLGATE.—What happened?

Mr. CLARK.—It was chord section 9 L anchor arm. One of the hooks broke, a connecting link on a hook broke and the chord section dropped on to the ground, striking a plate.

Prof. GALBRAITH.—At one end?

Mr. CLARK.—At one end, yes, sir. The splice plates were on the chord, that is the web splice plates were on the chord, and they struck a plate that we used in the yard, and the leverage on the plates broke two of the angles on the bottom of that rib.

Prof. GALBRAITH.—Struck edgewise or sideways?

Mr. CLARK.—Directly on the top side of the chord.

Prof. GALBRAITH.—Edgewise of the splice plates.

Mr. CLARK.—Edgewise, yes.

Mr. HOLGATE.—And was it one end of this piece that fell or the whole piece?

Mr. CLARK.—Both ends. One end fell on a pile of eye-bars and the other one fell 18 inches or 2 feet more.

Mr. HOLGATE.—How far did it fall?

Mr. CLARK.—Possibly 5 feet.

Prof. GALBRAITH.—How many falls were on the chord?

Mr. CLARK.—There were two cranes.

Prof. GALBRAITH.—And both broke?

Mr. CLARK.—No, one broke and that loosened the other one.

Prof. GALBRAITH.—So you let the whole chord fall?

Mr. CLARK.—Yes, sir, practically the whole chord.

Prof. GALBRAITH.—It struck one end first and struck sideways the rest.

Mr. CLARK.—Yes, sir.

Prof. GALBRAITH.—The other end did not strike the ground directly?

Mr. CLARK.—No, sir, the other end did not strike more than 20 inches.

Prof. GALBRAITH.—In handling this material had you any specific instructions?

Mr. CLARK.—Yes, sir.

Prof. GALBRAITH.—As to how to handle it?

Mr. CLARK.—Yes, sir.

Prof. GALBRAITH.—In what form were those instructions given to you?

Mr. CLARK.—For some of the principal members, all the chord sections, there are 60 ton hooks designed for the handling of them, and we have the two cranes and use them to handle them, that is a 60 ton hook on each end of the chord, thus giving us all the scope we needed.

Prof. GALBRAITH.—That is what you did?

Mr. CLARK.—Yes, sir.

Prof. GALBRAITH.—But were you instructed to do that?

Mr. CLARK.—Oh yes, we had two cranes. The hooks could not have been used at that time, only on two cranes.

Prof. GALBRAITH.—Were there specific instructions given you with regard to the handling of that material from the car?

Mr. CLARK.—Not all of them, the lighter members, of course there would not be anything given for that but the heavier members there was.

Prof. GALBRAITH.—Where did you get those instructions from?

Mr. CLARK.—We got the instructions from the blue prints and from the general plans. We have all the blue prints at the storage yard that we had at the bridge so far as the erection and handling of the metal is concerned.

Prof. GALBRAITH.—Then were the instructions that you refer to as blue prints followed?

Mr. CLARK.—Yes, sir.

Prof. GALBRAITH.—And in carrying out that work did you find these instructions ample for the handling of these parts?

Mr. CLARK.—Yes, sir.

Prof. GALBRAITH.—Is it usual on your work to receive instructions of that nature?

Mr. CLARK.—Well, not on smaller work we do not receive it, but on a work of this kind it is something unusual, and the instructions have been given and we have positive orders not to do anything only just what we get instructions to do, especially on a heavy member.

Prof. GALBRAITH.—Then you handle those members in the yard in accordance with the instructions you receive on blue prints that were furnished to you by whom?

Mr. CLARK.—The Phœnix Bridge Company.

Prof. GALBRAITH.—By whom at the Phœnix Bridge Company.

Mr. CLARK.—All blue prints and instructions come direct to the general foreman, and are turned over to the different foremen under him.

Prof. GALBRAITH.—Who was your immediate foreman on the work?

Mr. CLARK.—Mr. Yenser.

Prof. GALBRAITH.—With regard to this particular chord that you refer to, was it the only case of damage done to a member in the course of handling?

Mr. CLARK.—Yes, sir.

Prof. GALBRAITH.—When this happened what was done in the way of rectifying the matter?

Mr. CLARK.—It was repaired in the following spring, I think about May or June, I could not tell exactly. I could tell it was according to the Phœnix Bridge Company's tool order No. 200.

Prof. GALBRAITH.—Did you have to do with repairs?

Mr. CLARK.—It was under my supervision, yes, sir.

Prof. GALBRAITH.—And the repairs were done in the yard?

Mr. CLARK.—Yes, sir.

Prof. GALBRAITH.—Would you give us the date of that accident?

Mr. CLARK.—I cannot give you exactly. There is a record I presume in the Phœnix Bridge Company's office, but it was in April, I am almost positive.

Prof. GALBRAITH.—In what year?

Mr. CLARK.—1905.

Prof. GALBRAITH.—And the repairs were made the next spring?

Mr. CLARK.—Just a minute, 1905, the repairs were made that same spring.

Prof. GALBRAITH.—How long after the accident was the repair made, and when?

Mr. CLARK.—It was in the same year, two months and a half later. Of course, these repairs covered quite a few days. I could not give the exact date when the repairs were made.

Mr. HOLGATE.—The repairs were made, though ?

Mr. CLARKE.—Yes, sir.

Mr. HOLGATE.—Will you describe just what you did, shortly ?

Mr. CLARK.—The angles that were broken were cut off.

Mr. HOLGATE.—Which angles—the flange angles ?

Mr. CLARK.—The main angles in the chord section. I cannot give the exact locality now. The sheets will give that.

Mr. HOLGATE.—On the outside rib are the details of the work described on the tool order ?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—Will that describe it fully ?

Mr. CLARK.—Yes.

Mr. HOLGATE.—Can we get a copy of that ?

Mr. CLARK.—They are at the Bridge Company's office, I think.

Mr. HOLGATE.—You may, as nearly as you can recollect it now, give a description of it.

Mr. CLARK.—As near as I can recall it there were two angles broken and they were broken on the bottom of the chords. I cannot just recall whether they were outside or inside angles. I know one of them was an inside angle but the exact distance from the chord splice I cannot give without the tool order. But the chords were cut off and the splice made with perfect joints clipped and filed to the satisfaction of the engineer.

Mr. HOLGATE.—Who was the inspector?

Mr. CLARK.—Mr. Kinloch. The work was finished and the chord sections sent to the bridge at the proper time when it was required in the structure. Further, the work is there to show for itself. That entire end of the chord section is intact and can be seen at this time.

Prof. GALBRAITH.—That was the end of chord 9 joined to 10?

Mr. CLARK.—On the west side of the anchor arm.

Mr. HOLGATE.—What inspection was given to your work by the Quebec Bridge Company?

Mr. CLARK.—My work was usually inspected before it was erected. The inspectors usually got on the cars at the bridge and inspected the work that I had done—either Mr. McLure or Mr. Kinloch. They would make frequent visits to the yard and look over the work generally.

Mr. HOLGATE.—Who, besides Mr. Kinloch, did inspect chord A 9L after the repairs?

Mr. CLARK.—I would not be sure whether Mr. Kinloch had Mr. Hoare with him or not, but it seems to me that Mr. Hoare came to the yard one day to look over the repairs. I would not be positive.

Mr. HOLGATE.—But nobody else that you recollect ?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—Do you recollect Mr. McLure inspecting it?

Mr. CLARK.—No, I do not.

Mr. HOLGATE.—Do you recollect Mr. Hudson being there ?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—Did he see it ?

Mr. CLARK.—Yes, and Mr. Szlapka was with him at the same time.

Mr. HOLGATE.—I understand that that was after it had been repaired?

Mr. CLARK.—No, sir, before.

Mr. HOLGATE.—Did Mr. Hudson see it afterwards?

Mr. CLARK.—No, sir, I do not think so. I would not be sure whether Mr. Hudson saw it afterwards or not.

Mr. STUART.—I understand Mr. Hudson was there during the repair.

Mr. HOLGATE.—Was Mr. Hudson there during the repair?

Mr. CLARK.—I could not say as to that positively whether he was or not. The chord was looked over very carefully by Mr. Hudson and Mr. Szlapka before the repairs were made to it and looked over by different people at different times. I cannot recall who all were there.

Mr. HOLGATE.—Was your method of handling this chord different from that of handling similar chords?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—Was there a chain used in connection with the handling of this chord?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—In making the repair of the chord to what extent had you to use heat?

Mr. CLARK.—There was a Wells light put on the bend, on the angle almost opposite to where the repairs were made and that particular bend was taken out. The angle was bent in almost opposite the point of repair and that bend was taken out. We put a Wells light on it and we tried to get it warm enough to bend it back, but failing we did away with the heat and straightened it out with a ram.

Mr. HOLGATE.—By whose instructions were the details of these repairs carried out?

Mr. CLARK.—I think that the notes for the repairs were taken by Mr. Szlapka and Mr. Hudson. The two orders for the repairs, I think, you will find were given by Mr. Scheidel.

Mr. HOLGATE.—Will that order completely specify the method to be used in making these repairs?

Mr. CLARK.—Yes, sir; it does not tell you how to do the work, but it specifies the repairs.

Mr. HOLGATE.—Does it specify that the parts had to be heated?

Mr. CLARK.—No, sir. The reason that I abandoned heating was that we could not heat it with the Wells light. That was my own idea, and we could not get heat enough on it to straighten it with the Wells light, and so I abandoned that and straightened it with a ram.

Mr. HOLGATE.—Apart from using the Wells light, heat was not used?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—And you found the Wells light would not give sufficient heat to be of much use to you?

Mr. CLARK.—It would not give you enough heat.

Prof. GALBRAITH.—It was practically a cold bend?

Mr. HOLGATE.—What was the rule in regard to forwarding parts from the storage yard to the bridge?

Mr. CLARK.—Entirely laid out on our erection blue prints.

Mr. HOLGATE.—Upon whose instructions would you forward material to the bridge?

Mr. CLARK.—We had instructions to go by. I would know daily what was built up at the bridge and what would be required in rotation from the erection blue prints. We had a diagram to go by of the sections of the whole bridge and as for the minor details, little connections and pieces like that I would have to get these out myself.

Mr. HOLGATE.—When these parts were wanted at the bridge, would you be advised by Mr. Yenser?

Mr. CLARK.—If the order of erection would be changed from that print?

Mr. HOLGATE.—I mean that if he were ready for these parts, would he send you word that these parts were required?

Mr. CLARK.—No, we had to work a good deal ahead of them sometimes to have them ready, and they would go out sometimes before they were ready.

Mr. HOLGATE.—Who inspected these parts before they were forwarded to the bridge?

Mr. CLARK.—Nobody but myself.

Mr. HOLGATE.—Was there no inspection made in the storage yard by the Quebec Bridge Company?

Mr. CLARK.—Only in a general way, not a daily inspection, but the inspectors would look over the various members as they came up to the bridge.

Prof. GALBRAITH.—They inspected them at the bridge and not at the yard?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—Did you consider it necessary to have the Quebec Bridge Company's inspection before you forwarded the various parts to the bridge?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—How did you keep track of the members as you shipped them to the bridge?

Mr. CLARK.—I checked them off from the erection diagram.

Mr. HOLGATE.—On the diagram itself?

Mr. CLARK.—Yes. sir.

Mr. HOLGATE.—Would that give the date when they were forwarded?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—It would merely state that they had been sent?

Mr. CLARK.—That is all.

Mr. HOLGATE.—When you refer to an occasional inspection on the part of the Quebec Bridge Company in the yard, what individuals do you refer to?

Mr. CLARK.—Mr. McLure and Mr. Kinloch and occasionally a visit from Mr. Hoare, not as an inspector, but as taking a general observation.

Mr. HOLGATE.—Were there any occasions when they refused to permit the material to go from the yard to the bridge?

Mr. CLARK.—Not to my knowledge.

Mr. HOLGATE.—In the usual course this chord that you referred to was forwarded to the bridge?

Mr. CLARK.—The same as any other chord.

Mr. HOLGATE.—Have you any means of ascertaining, Mr. Clark, what of the material that you forwarded to the bridge had not been erected in the bridge at the time of the accident on the 29th of August?

Mr. CLARK.—There were only two members. There were two members I had just sent up that were not erected.

Mr. HOLGATE.—Which members were they?

Mr. CLARK.—Two sections of eye-bars—diagonal bars 20 in the suspended span.

Mr. HOLGATE.—Then I understand that all other material that had left the yard at that time had been erected in the structure and that only these chord bars had been forwarded and remained unerected and not yet placed in the structure?

Mr. CLARK.—Yes, sir. As I understand it, one set of bars had already been run to the front and the engine was going to the front with the last section.

Mr. HOLGATE.—What material yet remains in the yard?

Mr. CLARK.—The balance of the suspended span for the south half.

Mr. HOLGATE.—Have you any record, Mr. Clark, of material having gone to the bridge and having been returned to the storage yard?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—What have you reference to?

Mr. CLARK.—I have reference to U.S., V. 4. I think that is it. It was wrong side up.

Mr. HOLGATE.—In regard to this piece, you sent it, you say, wrong end on?

Mr. CLARK.—No, it was wrong side up. It was for the right side and I had it turned over to the left side. I had it turned wrong side up for the inner chord. It was just a matter of bringing it back and turning a five or six ton piece over; we turned it over on the same car, and it was not more than five minutes' work.

Mr. HOLGATE.—Are there any other cases of material being returned?

Mr. CLARK.—Not to my knowledge.

Mr. HOLGATE.—What became of the eye-bars that were run forward? They were not erected?

Mr. CLARK.—In the river, I guess.

Mr. HOLGATE.—Then, as I understand it, these eye-bars would be the only material on the bridge as far as you know that had not been erected in the structure?

Mr. CLARK.—These two sections of eye-bars.

Mr. HOLGATE.—You have no recollection of anything being run back off the bridge before the accident happened?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—You would have known if it had taken place?

Mr. CLARK.—There would not be anything to come back. The two chord sections were sent up and were in place and were being connected and there was nothing to send up between the chord sections and these eye-bars.

Mr. HOLGATE.—Is there any point, Mr. Stuart, you would like to mention?

Mr. STUART.—I have nothing.

Mr. DAVIDSON.—I understand that Mr. Clark is now speaking of the 29th, but Mr. Haley stated that these stringer pieces were sent back on the 28th.

Mr. HOLGATE.—Mr. Clark has stated that to his knowledge no material was sent back except this one piece of the post that was returned.

Mr. DAVIDSON.—Mr. Haley did not say they were sent back to the storage yard. They were sent back off the bridge—I do not know where to. Mr. Clark probably would not know this.

Mr. HOLGATE.—Have you any knowledge in regard to the return from the bridge of material that was intended for this erection or material which was connected with the apparatus for erection on the 28th of August?

Mr. CLARK.—Yes, there was one of the erection spans, that is the working span, sent back and put in on the side track until next day. I frequently would load these spans a day ahead. I frequently loaded various members a day ahead and sent them up; they would not be ready for them, and they would return them and put them on the side track until they were ready for them. I think it was the day before that I had loaded the erection span and sent it up, and Mr. Yenser had the crew return it and it was thrown on the side track until next day.

Mr. HOLGATE.—Had that been done before?

Mr. CLARK.—Possibly it had; I could not say positively. We used to have a side track there up in the cut, but not this year, that they probably would throw things in to hold them temporarily until they could take care of them on the bridge. In my work I worked as much as a month ahead on some of the members to prepare them and frequently a member would be run up before they were ready for it and it would be thrown in on the side track until such time as they could take care of it.

Mr. HOLGATE.—When these erection girders were returned from the bridge would they then be under your care?

Mr. CLARK.—Well, no; they just lie on the side track subject to the orders at the front.

Mr. HOLGATE.—Have you any knowledge as to why they were returned?

Mr. CLARK.—No, sir; no more than that they were not ready for them.

Prof. GALBRAITH.—Have you a record of everything returned to the side track?

Mr. CLARK.—No, sir.

Prof. GALBRAITH.—Have you any means of knowing what is in the side track officially without simply paying a chance visit?

Mr. CLARK.—Not from day to day. I do not keep any record.

Mr. HOLGATE.—How far is the storage yard from the side track?

Mr. CLARK.—About half a mile.

Mr. HOLGATE.—Your duties keep you at the storage yard constantly?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—Have you any duties which would take you to the siding where these cars are thrown in?

Mr. CLARK.—No, they are opposite the storage yard, possibly 300 or 400 feet away.

Mr. HOLGATE.—So that you would see the cars when they were returned?

Prof. GALBRAITH.—Do I understand that this side track that you speak of is one track and the siding is another track near the storage yard?

Mr. HOLGATE.—I think that what Mr. Clark means is that the siding where these cars were thrown in is 300 or 400 feet from the storage yard.

Mr. CLARK.—Probably 300 or 400 feet. It used to be the main line and it was used for storage purposes.

Mr. HOLGATE.—What do you mean by half a mile?

Mr. CLARK.—The storage yard is half a mile from the bridge.

Prof. GALBRAITH.—And this siding is somewhat less?

Mr. CLARK.—Yes, about 300 feet.

Mr. HOLGATE.—Did you see Mr. Yenser on the 28th?

Mr. CLARK.—Yes, I saw Mr. Yenser every day.

Mr. HOLGATE.—Did Mr. Yenser refer in any way to the return of these cars?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—Have you any knowledge as to why he returned them?

Mr. CLARK.—I asked the brakeman why he brought them back and he said they were not ready for them.

Mr. HOLGATE.—Who is the brakeman?

Mr. CLARK.—Homer Fontaine.

Mr. DAVIDSON.—Before you pass to another point, I would like you to ask this witness if it is not within his knowledge that there was a good deal of commotion amongst the men about these cars being sent back and a good deal of unrest—a good deal of feeling about them?

Mr. HOLGATE.—Did you hear comments made by any one in regard to the returning of the cars with the erection span on them?

Mr. CLARK.—Not until this time.

Mr. HOLGATE.—Until when?

Mr. CLARK.—Until the gentleman speaks of it now.

Mr. HOLGATE.—I would not refer to Mr. Davidson's conversation. You did not hear it.

Mr. CLARK.—All right.

Mr. HOLGATE.—Did you hear any comments?

Mr. CLARK.—No, sir, I never heard until this day why these girders came back.

Mr. HOLGATE.—None of the men commented on the matter to you?

Mr. CLARK.—No, sir; in my position I do not come into contact with them but very little; for this reason, that the men who boarded with me were, two of them, engineers, and one of them an apprentice, and I know that they did not mention anything in the house in relation to these girders going back. Most of the men lived in Liverpool, and I did not come into contact with any of them, and I never have, up to this time, heard anything as to why these girders went back. I never knew they were in question.

Mr. HOLGATE.—The only thing you can tell us is that the brakeman told you the reason they were sent back was that they were not ready for them at the front?

Mr. CLARK.—Yes, Mr. Yenser told him to take them back, they were not ready for them.

Mr. DAVIDSON.—Is that brakeman alive?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—Had you heard anything up to the 29th of August in regard to defects which were supposed to have existed in that structure?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—What was the nature of the information you had?

Mr. CLARK.—The information I got in a general way was that No. 9 chords were buckling.

Mr. HOLGATE.—A-9?

Mr. CLARK.—A-9, yes.

Mr. HOLGATE.—When did you hear that?

Mr. CLARK.—I could not say exactly. It might have been a day or two before the accident.

Prof. GALBRAITH.—Anything about the cantilever arm?

Mr. CLARK.—No, sir.

Mr. HOLGATE.—Who told you that, Mr. Clark?

Mr. CLARK.—I cannot recall who told me, but I questioned Mr. Birks on the day of the accident, possibly 15 or 20 minutes before the accident, and I asked him if there was any truth in what I heard. He said there was a bend in chord 9-L and to my recollection I think he said about an inch and five-eighths. And he also said: In spite of the fact that you and Mr. Kinloch may think that chord was entirely straight before it left the yard, it is my belief that the chord was in its present condition or nearly so when it went into the bridge.

Prof. GALBRAITH.—How long is it since that chord went into the bridge?

Mr. CLARK.—I could not give the exact date.

Prof. GALBRAITH.—Approximately?

Mr. CLARK.—It was 1905.

Mr. HOLGATE.—When Mr. Birks made that statement that it was in the same condition when it left the yard, what did you say?

Mr. CLARK.—I told him that he had a right to his own opinion and I had a right to mine, that from what I saw and from what others had seen I would retain my own opinion about the case. After that he got on the car and went to the bridge.

Mr. HOLGATE.—You checked that chord before it left the yard?

Mr. CLARK.—In a general way, yes.

Mr. HOLGATE.—Who else inspected it?

Mr. CLARK.—Mr. Kinloch.

Mr. HOLGATE.—Then, according to Mr. Birks' asertion at the time, there would have been a bend visible in the chord at the yard of an inch and five-eighths, you state?

Mr. CLARK.—That is what he told me about what the bend was, as nearly as I can recall. I could not recall the exact distance he did give.

Mr. HOLGATE.—Were there any other points that you ever heard reference made to, Mr. Clark?

Mr. CLARK.—No, sir.

Prof. GALBRAITH.—Did you see the fall of the bridge?

Mr. CLARK.—Nor, sir, I was at the yard at the time.

Prof. GALBRAITH.—Mr. Birks had just left you for the bridge?

Mr. CLARK.—Yes, about 15 minutes.

Prof. GALBRAITH.—Before the accident?

Mr. CLARK.—Yes.

Mr. HOLGATE.—In what condition did that chord leave the yard?

Mr. CLARK.—I have already answered that in a general way; from the observations I made of it, the chord was practically quite as good a chord as any other chord that ever left the yard.

Prof. GALBRAITH.—You had reason to make special observations in regard to that chord as it was the chord, I understand, which you were repairing in the yard?

Mr. CLARK.—Yes, sir.

Mr. HOLGATE.—Did you put a line on the chord?

Mr. CLARK.—No, sir. I do not think Mr. Birks saw the chord in the yard. I am not positive. I am not sure as to what time Mr. Birks came on the work.

Mr. HOLGATE.—Mr. Birks would see it going out on the bridge?

Mr. CLARK.—If he were here at that time. I cannot recall whether Mr. Birks was the engineer in charge at that time or not.

Mr. HOLGATE.—Would Mr. Birks have been there at that time, Mr. Deans?

Mr. DEANS.—When he first mentioned it I thought he was but it is possible that

our Mr. Hudson, our first assistant engineer, who was in the place occupied by Mr. Birks, may have seen the chord. He may have seen the chord and he superintended all the repairs of the chord. He was Mr. Szlapka's principal assistant.

Prof. GALBRAITH.—Do you remember whether he was here when the chord was placed in position?

Mr. DEANS.—It was either Mr. Hudson or Mr. Birks, because we always had an engineer on the ground. I think possibly it was Mr. Hudson.

Mr. CLARK.—I think Mr. Hudson was here when that chord was placed. I do not say exactly, but I think Mr. Hudson was here when that chord was placed.

Mr. HOLGATE.—Then Mr. Birks would have no personal knowledge?

Mr. STUART.—Except such as he would get from subsequent inspections after it was placed and what he said would be quite compatible with that, that there had been no change after it had been erected or since it had been in the bridge.

Prof. GALBRAITH.—If you had seen a deflection of an inch and five-eighths in the chord do you think you would have noticed it and been sure of it?

Mr. CLARK.—I think I would. An inch and five-eighths is quite a bit.

Witnessed discharged.

Commission adjourned to meet at ten a.m. Monday, September 16.

SEVENTH DAY.

QUEBEC, Monday, September 16, 1907.

The Commission resumed at ten a.m.

J. J. NANCE, sworn.

Mr. HOLGATE.—Were you an employee of the Phœnix Bridge Company on August 29th?

Mr. NANCE.—Yes, sir.

Mr. HOLGATE.—When did you commence work with the Phœnix Bridge Company in connection with the Quebec bridge work?

Mr. NANCE.—Two years ago last July past.

Mr. HOLGATE.—What was your position?

Mr. NANCE.—I was running the engine.

Mr. HOLGATE.—Were you running the engine all the time from the time you entered the service?

Mr. NANCE.—Yes. This summer, for a while, I was running lines.

Mr. HOLGATE.—What kind of lines?

Mr. NANCE.—Lines we were doing work with, hoisting and the like of that.

Mr. HOLGATE.—Working the tackle?

Mr. NANCE.—Yes.

Mr. HOLGATE.—You say you were running the engine. What engine?

Mr. NANCE.—One of the electric hoisting engines on the top of the little traveller.

Mr. HOLGATE.—You were engaged in doing that work on August 29?

Mr. NANCE.—Yes.

Mr. HOLGATE.—Were you there when the accident happened to the bridge?

Mr. NANCE.—Yes, sir.

Mr. HOLGATE.—You might tell us just what you observed at that time?

Mr. NANCE.—The only thing I knew was she went down so quick you did not have time to think of but very little. I went down from the top.

Prof. GALBRAITH.—You were near Mr. Haley?

Mr. NANCE.—Yes, sir.

Mr. HOLGATE.—Where was Mr. Haley?

Mr. NANCE.—Mr. Haley was out just on the fore jib giving signals to us on the engines we were on.

Prof. GALBRAITH.—Which way were you looking—straight to the north shore?

Mr. NANCE.—We faced that way.

Prof. GALBRAITH.—When the bridge began to go down?

Mr. NANCE.—Yes, sir.

Mr. HOLGATE.—You can really give no information as to what happened because you were in no position perhaps to observe at the time?

Mr. NANCE.—No, sir, I did not know anything about it. I knew very little after she started and the next second she was in the water and I was down in the water with it. I went to the bottom with the engine.

Prof. GALBRAITH.—Holding on?

Mr. NANCE.—Yes, to the controller handle.

Prof. GALBRAITH.—Were you struck by the wreck?

Mr. NANCE.—Yes, I have different injuries on me, in fact a muscle has pulled loose and a couple of ribs in the side—that is the worst, so the doctor told me.

Mr. HOLGATE.—Were you generally familiar with the whole bridge?

Mr. NANCE.—No sir. I have worked at anything I was put at, but I was never put at anything only the engines and on the lines. That is about all the work I ever did on the bridge. Probably half a day, or something like that, it would be raining, or something, and the engines were not running and I would be fitting up or working in the gang or anything that might be ready to do.

Mr. HOLGATE.—In your passing to and from the work, did you ever make any, what you would call, inspection, or was your attention called to anything in particular?

Mr. NANCE.—Yes, sir; on the day before we were going off the bridge after we came down from the work, from the top. We were walking off the bridge and many of our men on top there that day had been discussing quite a little in regard to a bent chord.

Mr. HOLGATE.—Who called your attention to it?

Mr. NANCE.—Mr. Cook was the first man. After we came down they went down on the chord.

Mr. HOLGATE.—They did?

Mr. NANCE.—Yes.

Mr. HOLGATE.—Who?

Mr. NANCE.—Mr. Cook and Mr. Haley, and I went on over the top of it. I did not go down on the chord, but they did.

Mr. HOLGATE.—What day was that?

Mr. NANCE.—On the 27th of August.

Prof. GALBRAITH.—That was two days before, then?

Mr. NANCE.—Yes.

Mr. STUART.—Did he say in the morning or the evening?

Mr. NANCE.—It was in the evening.

Mr. HOLGATE.—From your own knowledge you can tell us nothing about that detail?

Mr. NANCE.—No, sir, I do not remember very much of it, and I went down so quick.

Mr. HOLGATE.—I do not mean that; I mean in reference to this particular thing that Mr. Cook spoke to you about.

Mr. NANCE.—No, sir, I did not go down on that chord. All I heard them say was that they had heard the engineers say that it was bent.

Mr. HOLGATE.—Do you know which chord they referred to?

Mr. NANCE.—I think it was in around the third or fourth section from the big pier. That would make it about No. 9.

Mr. HOLGATE.—Outwards towards the river ?

Mr. NANCE.—Out near the water.

Mr. HOLGATE.—Was that in the anchor arm.

Mr. NANCE.—In the cantilever arm.

Mr. HOLGATE.—What impression did that information have on you at the time?

Mr. NANCE.—I do not know; I was not in a position to know very much about it, but there were some of them who seemed to be interested. I was a little scared but I did not want to be the first man to walk off. I wanted to stay as long as the rest of them stayed.

Mr. HOLGATE.—Were you ever on the lower chord yourself ?

Mr. NANCE.—Yes, sir.

Mr. HOLGATE.—In any part of the bridge ?

Mr. NANCE.—Yes, sir.

Mr. HOLGATE.—What particular part?

Mr. NANCE.—It was down on the pier in the first section, straight out over the water from the anchor.

Mr. HOLGATE.—At the anchor arm ?

Mr. NANCE.—Yes.

Mr. HOLGATE.—Which particular section have you reference to ?

Mr. NANCE.—I remember being on the upstream one. I went down to get a plank we wanted on the deck.

Mr. HOLGATE.—When was that ?

Mr. NANCE.—Last summer.

Mr. HOLGATE.—The summer of 1906 ?

Mr. NANCE.—Yes.

Mr. HOLGATE.—Why do you recall that particular incident ?

Mr. NANCE.—I was running the engine on the upstream side and we lost a couple of planks. One went overboard and one landed on the chord below and I went down to pull it up.

Mr. HOLGATE.—You did not go there for the purpose of looking at anything in particular in connection with the bridge ?

Mr. NANCE.—No, sir; I went there to put the hook on the plank and draw it up.

Mr. HOLGATE.—Did you observe anything peculiar with the bridge ?

Mr. NANCE.—No, sir.

Prof. GALBRAITH.—You are speaking now of a chord between the main pier and the shore ?

Mr. NANCE.—No, sir.

Mr. HOLGATE.—That is what I understand.

Mr. NANCE.—This was on the anchor arm, the first piece.

Prof. GALBRAITH.—Between the main pier and the shore ?

Mr. NANCE.—No, it is out over the water past the pier.

Prof. GALBRAITH.—It is past the pier towards the north shore ?

Mr. NANCE.—Yes.

Prof. GALBRAITH.—Then it is on the cantilever arm ?

Mr. NANCE.—Yes. Did you understand me to say that it was on the anchor ?

Mr. HOLGATE.—Yes.

Mr. NANCE.—It is just past the pier on the cantilever arm.

Mr. HOLGATE.—But, at any rate, you observed nothing at that time out of order ?

Mr. NANCE.—No, sir.

Mr. HOLGATE.—Did you observe anything at any other time out of order ?

Mr. NANCE.—No, sir.

Mr. HOLGATE.—Were you in a position to have noted these things if they had been there ?

Mr. NANCE.—Well, really, no sir, I was not, because where we were working you

were supposed to be at your work at seven o'clock, and it generally took about ten minutes to climb up there and the gang that worked up there never stopped any place down below to be sitting around.

Mr. HOLGATE.—In regard to the apparatus for hoisting, was it what you would call good reliable tackle ?

Mr. NANCE.—Yes, sir, the one I was running was as good as I ever saw.

Mr. HOLGATE.—You would say that it was suitable for the work that was being done ?

Mr. NANCE.—Yes, sir, it was.

Mr. HOLGATE.—And that it satisfactorily performed the work you wanted it to do?

Mr. NANCE.—Yes, easy.

Mr. HOLGATE.—Who were your foremen?

Mr. NANCE.—Our general foreman was Mr. Yenser. There was a foreman under him, Mr. Worley. Mr. Worley was generally on the work at all times with us.

Mr. HOLGATE.—Did you consider your foremen understood their work ?

Mr. NANCE.—Yes, sir, I believe they did.

Mr. HOLGATE.—You refer now to Mr. Worley and also to Mr. Yenser ?

Mr. NANCE.—Yes, I think both of them understood it and especially that work that they had been on two or three years; I think it could not have been better.

Mr. HOLGATE.—Although the work was, to a certain extent a hazardous work, you had confidence in your foremen ?

Mr. NANCE.—Yes, sir.

Mr. HOLGATE.—And in the tackle ?

Mr. NANCE.—Yes.

Mr. HOLGATE.—And in their methods of doing the work ?

Mr. NANCE.—Yes. I never saw as good methods of doing everything as I saw there.

Mr. HOLGATE.—I dare say, Mr. Nance, that you heard a good many statements since this accident happened in regard to certain defects that are said to have been observed ?

Mr. NANCE.—Oh, yes, lots of them.

Mr. HOLGATE.—Have any of the men that have observed these things spoken to you about them ?

Mr. NANCE.—Nobody but Mr. Cook, the time I told you about.

Mr. HOLGATE.—Since the accident has anybody ?

Mr. NANCE.—No, I do not think they have.

Mr. HOLGATE.—Do you know of any man who, you think, would be able to give us any information from his own knowledge ?

Mr. NANCE.—No, sir, I do not know of a man that could help you in that respect, because I guess it was a surprise to them as well as it was to me.

Mr. HOLGATE.—I do not refer so much to the accident itself but to the condition of the bridge prior to the accident.

Mr. NANCE.—I do not know of any man.

Mr. HOLGATE.—On the day of this accident you were on the forward traveller. Did you notice anything peculiar at all ?

Mr. NANCE.—No, sir, I did not.

Mr. HOLGATE.—Nothing peculiar in the action of the bridge different from any other day ?

Mr. NANCE.—No, sir, I could not see any difference at all.

Mr. HOLGATE.—No unusual vibration or springing action ?

Mr. NANCE.—No, sir.

Mr. HOLGATE.—It was just the same as it had been?

Mr. NANCE.—It was just the same right up to the moment she went down.

Mr. HOLGATE.—Was there at any time any such motion felt by you?

Mr. NANCE.—No, sir.

Witness discharged.

John E. SPLICER, sworn.

Mr. HOLGATE.—Are you an employee of the Phœnix Bridge Co., Mr. Splicer?

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—When did you begin working at the Quebec Bridge with the Phœnix Bridge Company?

Mr. SPLICER.—I started last September, working.

Mr. HOLGATE.—September, 1907?

Mr. SPLICER.—1906.

Mr. HOLGATE.—Then you have been working there nearly a year?

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—What part of the work were you on?

Mr. SPLICER.—Most of it, I guess.

Mr. HOLGATE.—You might tell us what you were doing from September, 1906?

Mr. SPLICER.—Well, I worked on the false work when I first went there, and afterwards I went into a riveting gang, and then I went on a raising gang, and then I went up on the traveller.

Mr. HOLGATE.—Which traveller?

Mr. SPLICER.—The big traveller.

Mr. HOLGATE.—On August 29, where were you working?

Mr. SPLICER.—I was not working at all.

Mr. HOLGATE.—What is the nearest date to August 29 you were working?

Mr. SPLICER.—The day before.

Mr. HOLGATE.—Then you worked on the 28th?

Mr. SPLICER.—The 28th.

Mr. HOLGATE.—On the 28th were you working on the big traveller?

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—What were they doing with the big traveller?

Mr. SPLICER.—I was taking pins out of them sheaves up there, that is alongside the traveller there, taking the pins out, and one thing and another, taking the girders down, we were taking it down.

Mr. HOLGATE.—That is what has been described as taking down the big traveller?

Mr. SPLICER.—Taking down the big traveller.

Mr. HOLGATE.—What was the cause of your absence on the 29th?

Mr. SPLICER.—I do not know, I felt nervous, I guess.

Mr. HOLGATE.—Had you been constantly at work prior to that time?

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—Had you felt nervous before?

Mr. SPLICER.—No, not till about a week before.

Mr. HOLGATE.—What was the cause of your nervousness?

Mr. SPLICER.—Well, I do not know, I do not know the cause of it at all, it just came into me that way.

Mr. HOLGATE.—And was that the cause of your taking a holiday on the 29th.

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—Did you intend to go back to work?

Mr. SPLICER.—Yes, I intended to go back to work noon; I was lying off in the morning and intended to go back noon, but it got later.

Mr. HOLGATE.—You just laid off in the morning?

Mr. SPLICER.—Just laid off in the morning; I was going to Quebec, but I didn't go to work in the afternoon, it was too windy, and I went to Quebec in the afternoon.

Mr. HOLGATE.—What was the cause of your uneasiness or nervousness?

Mr. SPLICER.—It was the chord.

Mr. HOLGATE.—No, with regard to your lying off that morning?

Mr. SPLICER.—In the morning? I was talking about the chord the night before, the whole bunch of us.

Mr. HOLGATE.—Then you decided, though, to go to work in the afternoon?

Mr. SPICER.—Yes, sir, I decided.

Mr. HOLGATE.—And you did not go to work because the wind was blowing too hard?

Mr. SPLICER.—The wind was blowing too hard.

Mr. HOLGATE.—Was it an unusual wind?

Mr. SPLICER.—No, we generally get that every now and then. Of course I had been working up on the traveller on windy days, it is not very comfortable.

Mr. HOLGATE.—The real reason then for your not returning to work was the wind?

Mr. SPICER.—The wind, yes, sir.

Mr. HOLGATE.—And not anything else?

Mr. SPLICER.—No, sir.

Mr. HOLGATE.—And your cause for the nervousness in lying off for wind that morning was the chord, you say?

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—You might explain just what you mean?

Mr. SPLICER.—The bent chord there; we were talking about it the night before.

Mr. HOLGATE.—Who?

Mr. SPLICER.—About seven or eight of us, they were all Indians working down there.

Mr. HOLGATE.—Who are these men, do you remember?

Mr. SPLICER.—There was Solomon Angus, Joe Mitchell, Mitchell Adams, and four of them, there is John Jocko, and they all boarded in the same place, Joseph Dion, Lewis Dibeau.

Mr. HOLGATE.—Are any of these men living?

Mr. SPLICER.—No, sir, none of them.

Mr. HOLGATE.—What list is that you are referring to?

Mr. SPLICER.—Only the names of the Indian boys, that is all.

Mr. HOLGATE.—When was that made?

Mr. SPLICER.—I made that out myself, just the boys that were killed, all the Indian boys.

Mr. HOLGATE.—And none of these men are available? Do you know if any of these men saw what they spoke to you about?

Mr. SPLICER.—The way they talked that night, they said they did. They said there was a place in that chord, I do not know whereabouts, where it was bent, and they were trying to jack it together, and they could not jack the plates together and riveted it up the way it was, that is the way they were saying the night before. My mother heard them, too.

Mr. HOLGATE.—When did this conversation take place?

Mr. SPLICER.—The 28th, the night before the accident.

Mr. HOLGATE.—Did you see this chord yourself?

Mr. SPLICER.—No, I did not go down at the chord, I worked out on the side, and just had a glance at it, that is all.

Mr. HOLGATE.—Was that on the evening of the 28th?

Mr. SPLICER.—No, it was on Tuesday I had a glance at it.

Mr. HOLGATE.—That is before you had this conversation?

Mr. SPLICER.—Oh, yes, that is before we had this conversation.

Mr. HOLGATE.—What took you there?

Mr. SPLICER.—Well, they were talking about it.

Mr. HOLGATE.—They talked about it before the 28th; who was with you at that time?

Mr. SPLICER.—Who was with me, I do not know his name; he showed me it. Do you know him, Haley, that Nova Scotia fellow, the fellow from Nova Scotia?

Mr. HALEY.—Jim Bowen.

Mr. SPLICER.—Jim Bowen.

Mr. HOLGATE.—Is he living?

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—Do you know where he is now?

Mr. SPLICER.—He has gone home, I understand, back to New Brunswick.

Mr. HOLGATE.—What did you see?

Mr. SPLICER.—I just saw the bend, that is all, just a glance at it.

Mr. HOLGATE.—Just the——

Mr. SPLICER.—Chord bent, that is all.

Mr. HOLGATE.—Do you remember what chord it was?

Mr. SPLICER.—No, sir, it was on this side of the pier, that is all I know.

Mr. HOLGATE.—That is on the river side of the pier?

Mr. SPLICER.—On this side, towards the north side there.

Mr. HOLGATE.—It was north of the cantilever pier?

Mr. SPLICER.—The cantilever arm.

Mr. HOLGATE.—It was in the cantilever arm?

Mr. SPLICER.—Yes.

Mr. HOLGATE.—On the Quebec or Montreal side?

Mr. SPLICER.—The Quebec side.

Mr. HOLGATE.—How many panels was it out from the pier?

Mr. SPLICER.—I could not say, three or four, I think.

Mr. HOLGATE.—What do you remember about the chord itself?

Mr. SPLICER.—Nothing at all, that is all I know, I just had a glance at it and went by. I was talking about it on my way to——

Mr. HOLGATE.—Did you call the attention of any other person to that?

Mr. SPLICER.—No, sir.

Mr. HOLGATE.—If you had considered it of sufficient importance, you would have called the attention of your foreman to it, or some person.

Mr. SPLICER.—Well, I thought it was safe myself. I do not know much about that iron. I thought it was safe, it never bothered me any.

Mr. HOLGATE.—So far as your judgment went then there was nothing that you saw that caused you alarm?

Mr. SPLICER.—No, sir.

Mr. HOLGATE.—Had you a feeling of confidence or otherwise in the foremen who were over you in this bridge erection; did you think that they were competent men?

Mr. SPLICER.—Yes, sir, good men.

Mr. HOLGATE.—To whom do you refer now?

Mr. SPLICER.—All of them, I should think; I found them all good men.

Mr. HOLGATE.—And with regard to the appliances that were used in the handling were they safe?

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—Do you recollect any occasion where failure took place in the tackle in the handling of the material?

Mr. SPLICER.—No sir.

Mr. HOLGATE.—Not any occasion during the year that you were there?

Mr. SPLICER.—No, sir.

Mr. HOLGATE.—Did you observe at any time any unusual vibration, either sideways or up and down?

Mr. SPLICER.—No, sir.

Mr. HOLGATE.—And you say that on several occasions you have had high winds?

Mr. SPLICER.—Yes, sir.

Mr. HOLGATE.—Had you any feeling of insecurity?

Mr. SPLICER.—No, sir.

Mr. HOLGATE.—And even after you learned all of the conditions that were described with regard to the chord, you thought it was safe?

Mr. SPLICER.—I thought it was safe, yes, sir.

Witness discharged.

PERCY WILSON, sworn.

Mr. HOLGATE.—Are you an employee of the Phœnix Bridge Company?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—How long have you been with them.

Mr. WILSON.—This is the second summer.

Mr. HOLGATE.—Where were you engaged at work?

Mr. WILSON.—In the storage yard. This last four weeks I was on the bridge.

Mr. HOLGATE.—In the storage yard up to four weeks ago?

Mr. WILSON.—Three or four weeks, I am not sure.

Mr. HOLGATE.—That is you were working on the bridge three or four weeks?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—In what capacity were you working in the storage yard?

Mr. WILSON.—Oh, just as a common labourer.

Mr. HOLGATE.—Who was your foreman?

Mr. WILSON.—A man by the name of Clark.

Mr. HOLGATE.—Then when you went on the bridge what were your duties?

Mr. WILSON.—I was just serving the riveters.

Mr. HOLGATE.—All the time?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—Who was your foreman there?

Mr. WILSON.—It was a tall man by the name of Slim. I guess his name was Meredith, I am not sure.

Mr. HOLGATE.—Did Meredith survive the accident of the 29th?

Mr. WILSON.—Yes, sir, he was working on the 29th.

Mr. HOLGATE.—Did he survive that accident?

Mr. WILSON.—No, sir, he is gone.

Mr. HOLGATE.—Where were you working on the 29th August?

Mr. WILSON.—On the bridge, sir.

Mr. HOLGATE.—At what point?

Mr. WILSON.—When the bridge went I was just going ashore for rivets, and I turned around, I saw the bridge going.

Mr. HOLGATE.—What part of the bridge were you on?

Mr. WILSON.—On the span that is left, the shore span.

Mr. HOLGATE.—You were on the bridge?

Mr. WILSON.—No, sir, I was not on the part that went.

Mr. HOLGATE.—Did you see Huot?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—Where was he?

Mr. WILSON.—We ran away, the three of us, Ouimet——

Mr. HOLGATE.—Huot and yourself and Ouimet ran off together?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—Just prior to that where had you come from on the bridge?

Mr. WILSON.—I was just coming from outside the anchor pier.

Mr. HOLGATE.—Where was the riveting gang working at this time?

Mr. WILSON.—Oh, there were about eight gangs of riveters then; they were working all along.

Mr. HOLGATE.—Were you serving one gang or more?

Mr. WILSON.—One.

Mr. HOLGATE.—Where was it working at the time of the accident?

Mr. WILSON.—About 300 feet outside the pier.

Prof. GALBRAITH.—The anchor pier?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—Which side of the bridge, the Quebec or Montreal side.

Mr. WILSON.—The Montreal side.

Mr. HOLGATE.—Do you remember what part of the structure they were working on?

Mr. WILSON.—All on the bottom chord.

Prof. GALBRAITH.—Was that the fifth or sixth span?

Mr. WILSON.—I could not say exactly, but it was about 300 feet outside the pier.

Prof. GALBRAITH.—How do you count the 300 feet, how do you estimate it, by the number of chords or how?

Mr. WILSON.—No sir, I could not say what number of chords they were out.

Prof. GALBRAITH.—You do not know whether it was the fifth or sixth chord or the ninth.

Mr. WILSON.—No, sir, I do not; it was the distance outside the pier.

Prof. GALBRAITH.—It was not the ninth chord?

Mr. WILSON.—No, sir.

Prof. GALBRAITH.—Are you sure it was not?

Mr. WILSON.—Well, the ninth chord they were talking about was inside the pier, I guess.

Prof. GALBRAITH.—Inside the centre pier?

Mr. WILSON.—Yes, sir.

Prof. GALBRAITH.—You were on the anchor arm inside the centre pier?

Mr. WILSON.—No, it is about 300 feet outside the pier.

Prof. GALBRAITH.—Outside the main pier?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—On the cantilever arm?

Mr. WILSON.—Outside.

Mr. HOLGATE.—You were serving the men with rivets; were your serving the riveters with the hot rivets?

Mr. WILSON.—No, sir.

Mr. HOLGATE.—Then were you distributing the cold rivets amongst the various riveting gangs, is that it?

Mr. WILSON.—That is it.

Mr. HOLGATE.—Who were in the gang that Meredith was handling?

Mr. WILSON.—Well, he handled the whole of them.

Mr. HOLGATE.—He handled all the gangs?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—Where were the other riveting gangs located that day?

Mr. WILSON.—There was a gang on the pier.

Mr. HOLGATE.—On the cantilever pier?

Mr. WILSON.—Yes, sir, and two gangs inside the pier and the rest were outside the pier.

Mr. HOLGATE.—Two gangs inside the pier towards the——

Mr. WILSON.—The shore, one on each side.

Mr. HOLGATE.—One on each side of the bridge?

Mr. WILSON.—Of the bridge.

Mr. HOLGATE.—And where were the others?

Mr. WILSON.—Outside the pier.

Mr. HOLGATE.—That made how many gangs altogether?

Mr. WILSON.—There were some riveting that morning, I think there were seven or eight, there were generally nine.

Mr. HOLGATE.—One was on the pier, two were on the land side of the pier and the other gangs on the cantilever arm.

Mr. WILSON.—Yes, sir, outside the bridge.

Mr. HOLGATE.—Now, we will begin with those working on the anchor arm; you say there two gangs there, one on each side?

Mr. WILSON.—One on each side.

Mr. HOLGATE.—Do you know at what joint they were working?

Mr. WILSON.—No, sir.

Mr. HOLGATE.—Can you locate them in any way?

Mr. WILSON.—I do not think so.

Mr. HOLGATE.—Were they working on floor beams or chords?

Mr. WILSON.—On chords, both of them on chords.

Mr. HOLGATE.—They were both working on chords but you do not know which chord?

Mr. WILSON.—I could not say, sir.

Mr. HOLGATE.—Then the gang that was working on the pier, what were they doing?

Mr. WILSON.—Well, they seemed to me to be riveting the shoe on the pier.

Mr. HOLGATE.—On which side of the bridge, the Montreal or Quebec side?

Mr. WILSON.—The Quebec side.

Mr. HOLGATE.—Can you locate the gangs on the cantilever arm?

Mr. WILSON.—No, sir, I could not.

Mr. HOLGATE.—Were there others doing the same kind of work as you?

Mr. WILSON.—There were two that afternoon.

Mr. HOLGATE.—Two distributing rivets to all these gangs?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—Who was the other?

Mr. WILSON.—He worked only the day before, three days he was there, I do not know who he was; he said he came from Montreal, two of them came together.

Mr. HOLGATE.—Where is he now?

Mr. WILSON.—He is down, he is dead, I did not see him; he was a Canadian.

Mr. HOLGATE.—You say there were three, was there another one?

Mr. WILSON.—Well, he was serving the rivets in the forenoon and he put him painting in the afternoon.

Mr. HOLGATE.—Where is he now?

Mr. WILSON.—He is dead, too.

Mr. HOLGATE.—Now, these riveting gangs working on the cantilever arm, were they working on the floor beams, riveting?

Mr. WILSON.—They were working on the bottom chords.

Mr. HOLGATE.—Were they all working on bottom chord work?

Mr. WILSON.—Only those two inside the piers, and then there was a gang on the pier.

Mr. HOLGATE.—I was referring to those on the cantilever arm?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—They were working where?

Mr. WILSON.—On the bottom chord.

Mr. HOLGATE.—All on bottom chord work?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—Do you remember who they were in that gang that was working on the pier?

Mr. WILSON.—No, sir, they were Indians.

Mr. HOLGATE.—Do you know if any of them are now alive?

Mr. WILSON.—I do not think so.

Mr. HOLGATE.—Which way were you going when the accident happened to the bridge?

Mr. WILSON.—I was going ashore, toward the shore.

Mr. HOLGATE.—And you were, I think you said, on the approach span?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—What did you first notice?

Mr. WILSON.—Well, I heard a noise and I turned around and I saw it going from the pier like a flash of lightning.

Mr. HOLGATE.—Which pier?

Mr. WILSON.—From the far pier, I mean the pier that is in the cantilever arm.

Mr. HOLGATE.—Just in your own words tell us what you noticed at that time?

Wr. WILSON.—All I noticed was when I turned around and seen the bridge going. It took about five or six seconds and then all I seen was floating timber on the river and a mass of steel was between the two piers.

Mr. HOLGATE.—What did you do after that?

Mr. WILSON.—I turned around and ran down below a stairs there, the steps. I had a brother working on the traveller, and I had another brother working under the bridge, and I thought I would see him down below, and when I got down tnere I did not see him; they were gone, both of them.

Mr. HOLGATE.—When you were going backwards and forwards on the bridge, serving the gangs with rivets for about a month did you observe anything out of order or was your attention called to anything apparently out of order?

Mr. WILSON.—No, sir, I never did.

Mr. HOLGATE.—Did anybody ever speak to you?

Mr. WILSON.—Yes, I heard lots about it but I never minded them, I thought it would never——

Mr. HOLGATE.—Do you remember what that information was?

Mr. WILSON.—I heard them speaking about a cracked bottom chord, I never seen it myself.

Mr. HOLGATE.—Was that what they said, a cracked bottom chord?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—Do you remember who said that to you?

Mr. WILSON.—Well, my brother often spoke of it.

Mr. HOLGATE.—Was there anybody else?

Mr. WILSON.—Oh, yes.

Mr. HOLGATE.—Is there anybody that is living now that you heard use that expression?

Mr. WILSON.—Yes, there was a young painter by the name of Donat Nadeau.

Mr. HOLGATE.—Was he lost?

Mr. WILSON.—No, sir.

Mr. HOLGATE.—Where is he?

Mr. WILSON.—At St. Romuald.

Mr. HOLGATE.—Did he give you any description of it?

Mr. WILSON.—No, sir, he did not.

Mr. HOLGATE.—Do you remember when he told you about it?

Mr. WILSON.—Yes, sir.

Mr. HOLGATE.—When?

Mr. WILSON.—Oh, it was the day before, he spoke to me about it.

Mr. HOLGATE.—The day before——

Mr. WILSON.—The accident.

Mr. HOLGATE.—Did he give you to understand he had seen it?

Mr. WILSON.—No, I forget if he did say if he had seen it or not, but I know they spoke about it.

Mr. HOLGATE.—You did not see it?

Mr. WILSON.—No, sir.

Mr. HOLGATE.—Do you remember if Nadeau specified which chord he referred to?

Mr. WILSON.—No, sir, he said it was near the pier, near the caisson.

Mr. DAVIDSON.—Did he tell you what was the matter?

Mr. WILSON.—He said it was cracked.

Mr. HOLGATE.—Did you understand from what he said whether it was on the cantilever or the anchor arm?

Mr. WILSON.—I think it was on the cantilever arm, I did not pay much attention to it, because I did not believe it.

Witness discharged.

AIME GINGRAS, sworn. (Testimony given in French).

Prof. GALBRAITH.—You are employed by the Phœnix Bridge Company?

Mr. GINGRAS.—Yes, sir.

Prof. GALBRAITH.—Were you working the day of the accident?

Mr. GINGRAS.—Yes, sir.

Prof. GALBRAITH.—What had you to do there?

Mr. GINGRAS.—I was carrying water to the office.

Prof. GALBRAITH.—Where were you at the time of the accident?

Mr. GINGRAS.—I was right near the office.

Prof. GALBRAITH.—What did you see?

Mr. GINGRAS.—I saw the bridge fall.

Prof. GALBRAITH.—Will you describe its appearance as it fell?

Mr. GINGRAS.—I know nothing about that; it fell with a crash.

Prof. GALBRAITH.—Did you watch it during the whole time of the fall?

Mr. GINGRAS.—No.

Prof. GALBRAITH.—In your duties did you go daily from one part of the bridge to the other?

Mr. GINGRAS.—Yes, going messages.

Prof. GALBRAITH.—Did you ever hear anything said about the bridge being dangerous.

Mr. GINGRAS.—I had heard that the bridge was going to fall.

Prof. GALBRAITH.—Do you know the names of the men who told you that?

Mr. GINGRAS.—No, I do not know them.

Prof. GALBRAITH.—Do you know the men even although you do not know their names?

Mr. GINGRAS.—I do not think I know them.

Prof. GALBRAITH.—How long have you been working on the bridge?

Mr. GINGRAS.—Two years.

Prof. GALBRAITH.—And yet you would not recognize any man who spoke about the bridge being dangerous?

Mr. GINGRAS.—I do not know that at all.

Prof. GALBRAITH.—Not by sight?

Mr. GINGRAS.—I did not look at them for any length of time, I just was passing near them when they said that.

Mr. GINGRAS.—When did you hear that?

Mr. GINGRAS.—The morning of the accident, I thought they were only joking.

Prof. GALBRAITH.—Was anything on the bridge pointed out to you as being dangerous?

Mr. GINGRAS.—No.

Prof. GALBRAITH.—Did you see anything yourself?

Mr. GINGRAS.—No.

Witness discharged.

The Commission took recess.

AFTERNOON SESSION—SEVENTH DAY.

Commission resumed at two o'clock.

RAOUL LAFRANCE, sworn.

Mr. HOLGATE.—Were you an employee of the Phœnix Bridge Company?

Mr. LAFRANCE.—Yes, sir.

Mr. HOLGATE.—When did you enter their employment?

Mr. LAFRANCE.—At the beginning of July.

Mr. HOLGATE.—Were you employed with them constantly?

Mr. LAFRANCE.—I had left off work for about ten days before the bridge fell. I, as a rule, worked with the electrician, Mr. Britton.

Mr. HOLGATE.—What else did you do?

Mr. LAFRANCE.—I carried rivets, and painting, and all kinds of work.

Mr. HOLGATE.—Who was your foreman?

Mr. LAFRANCE.—I do not remember his name. They used to call him Benny.

Mr. HOLGATE.—How long were you painting?

Mr. LAFRANCE.—I did not work the whole time at the painting. I painted only when I had nothing else to do.

Mr. HOLGATE.—Who was your foreman when you were painting?

Mr. LAFRANCE.—My cousin, who was the head of the gang—Alexandre Ouimet.

Mr. HOLGATE.—Is he here?

Mr. LAFRANCE.—No, he is gone.

Mr. HOLGATE.—Where?

Mr. LAFRANCE.—I do not know where he has gone to. He has left for Ontario.

Mr. HOLGATE.—When did he leave?

Mr. LAFRANCE.—Saturday afternoon.

Mr. HOLGATE.—Did he tell you where he was going?

Mr. LAFRANCE.—I do not know. I know he took the C. P. R. train and left for Ontario. He has gone to the shanties there. He gave me the name of the place, but I do not remember.

Mr. HOLGATE.—Who knows?

Mr. LAFRANCE.—I do not know.

Mr. HOLGATE.—And you do not know where he is to be found now?

Mr. LAFRANCE.—No.

Mr. HOLGATE.—Did your work carry you about the different parts of the bridge?

Mr. LAFRANCE.—Yes, I went everywhere—it was immaterial to me—anywhere at all,—I was ready to go.

Mr. HOLGATE.—In going about the bridge, did you notice anything at all out of the ordinary?

Mr. LAFRANCE.—The only thing I noticed was a crack on the pile.

Mr. HOLGATE.—Was that a crack in the pier?

Mr. LAFRANCE.—No, it was above the shoe on the plate.

Mr. HOLGATE.—How wide was that crack?

Mr. LAFRANCE.—About 18 or 20 inches long.

Mr. HOLGATE.—How wide was the crack?

Mr. LAFRANCE.—It was open about as thick as a little finger.

Mr. HOLGATE.—Did you examine the crack yourself?

Mr. LAFRANCE.—Yes, I looked at it. I did not go up on top to look at it though I saw it.

Mr. HOLGATE.—Where were you when you saw it?

Mr. LAFRANCE.—On the pier. I was cleaning the pier. My cousin, Mr. Ouimet, drew my attention to it.

Mr. HOLGATE.—How far would that be that you were from the crack when you noticed it?

Mr. LAFRANCE.—Between 6 and 8 feet from it. I was cleaning the pier and Ouimet brought me to look at it.

Mr. HOLGATE.—Did you see it more than once?

Mr. LAFRANCE.—I looked at it three or four days.

Mr. HOLGATE.—The same day?

Mr. LAFRANCE.—I was three days on the pier and I looked at it every day. I was cleaning the pier, gathering the bolts and everything that was there.

Mr. HOLGATE.—Did that crack go out to the edge of the plate?

Mr. LAFRANCE.—No.

Mr. HOLGATE.—Did it go down as if it were torn from the edge of the plate?

Mr. LAFRANCE.—The plate was square, and——

Mr. HOLGATE.—There is a piece of paper (handing witness a sheet of white paper) just tear it the way you say the crack. (Witness tore the paper.) Was it in that position, upright?

Mr. LAFRANCE.—The crack was on the lower part of the Quebec side of a pier on the Montreal side.

Mr. HOLGATE.—Then the crack did extend out to the edge of the plate?

Mr. LAFRANCE.—It did not extend as far as the middle, but it was about 18 or 20 inches in length. The plate was 6 or 8 feet square. That is what it seemed to me.

Mr. HOLGATE.—You were three days on the pier, so that probably you had the whole matter very clearly in your head?

Mr. LAFRANCE.—Yes.

Mr. HOLGATE.—And you probably would recognize a photograph of that place?

Mr. LAFRANCE.—Yes.

Mr. HOLGATE.—Look at this photograph and tell us if that shows that plate? (Witness was shown a photograph.)

Mr. LAFRANCE.—Is that a photograph of the pier on the Montreal side or the Quebec side?

Mr. HOLGATE.—They are both alike, I understand.

Mr. LAFRANCE.—The plate was on the other side.

Mr. STUART.—There is one there shown which corresponds, I think.

Mr. HOLGATE.—The two sides are exactly alike.

Mr. LAFRANCE.—To give you the directions it would be better if I had the pier on the Montreal side.

Mr. HOLGATE.—This is not the identical plate shown in the photograph but is the plate on the Quebec side corresponding with the one on the Montreal side which you have been describing.

Mr. LAFRANCE.—The plate the crack was in cannot be seen on that photograph. It was on the inside of that.

Mr. HOLGATE.—Was the plate lying flat?

Mr. LAFRANCE.—No, vertical.

Mr. HOLGATE.—This photograph shows the whole arrangement at the shoe?

Mr. LAFRANCE.—Yes. (Photograph put in and marked Exhibit No. 29.)

Mr. HOLGATE.—Is that plate marked X on exhibit No. 29, the plate you mean?

Mr. LAFRANCE.—No, it is a plate that was above that one and at the back of it on the Montreal side.

Mr. STUART.—Does he say the crack is on the Montreal side?

Mr. LAFRANCE.—On the Quebec side of a Montreal side plate.

Mr. HOLGATE.—Did you notice particularly the plate marked X?

Mr. LAFRANCE.—Yes.

Mr. HOLGATE.—Do you remember that plate?

Mr. LAFRANCE.—Yes.

Mr. HOLGATE.—Was that plate cracked?

Mr. LAFRANCE.—No. If there was any crack I did not see it, and I was cleaning that plate.

Mr. DAVIDSON.—Of course, I have no doubt the commissioners recognize how difficult it is for any one, much less a boy like this, to recognize from a photograph—I know it would be extremely difficult for me, entirely unacquainted with bridge work and structures like that—the exact point that was referred to.

Mr. HOLGATE.—He has recognized this particular plate and he is positive there was no crack in it.

Mr. DAVIDSON.—That is not a photograph of the plate he saw at all.

Mr. HOLGATE.—But he says he cleaned this plate and there is no crack in it.

Prof. GALBRAITH.—Is it the corresponding plate on the other side?

Mr. LAFRANCE.—I worked on and cleaned every one of them.

Mr. DAVIDSON.—Ask him what he means when he says: 'La plaque en question etait dans cette position.' Does he mean straight up and down or slanting?

Mr. LAFRANCE.—Slightly inclined.

Mr. DAVIDSON.—Do you see in that photograph the plate in which you saw the crack?

Mr. LAFRANCE.—No.

Mr. HOLGATE.—Do you know the part of the bridge called the shoe?

Mr. LAFRANCE.—Yes, that is the lower part that was on the pier.

Mr. DAVIDSON.—Is that right, Mr. Kinloch?

Mr. KINLOCH.—No.

Mr. LAFRANCE.—I do not know much about it.

Mr. DAVIDSON.—When you stood on the pier looking at the plate was it above your head or in front of you?

Mr. LAFRANCE.—It was above my head.

Mr. HOLGATE.—Was there anything above your head? You were standing on the pier?

Mr. LAFRANCE.—I was standing on the pier.

Mr. HOLGATE.—Naturally, it would be above his head.

(NOTE.—Witness was shown the photograph reversed against the light in order to bring the corresponding parts shown as appearing on the Quebec side and was then enabled to identify the plate that he refers to by an ink mark on the back of the photograph.)

Mr. HOLGATE.—The mark that appears on the back of this photograph, exhibit No. 29, then, is your own mark identifying the plate you refer to?

Mr. LAFRANCE.—Yes, that is what I saw.

Mr. HOLGATE.—You think you would recognize that plate again?

Mr. LAFRANCE.—Yes, sir.

Mr. HOLGATE.—What was the last time that you observed this plate?

Mr. LAFRANCE.—About two or three weeks before the accident.

Mr. HOLGATE.—How many times since that time did you see it?

Mr. LAFRANCE.—I looked at it three or four times.

Mr. HOLGATE.—What was the last time you saw it?

Mr. LAFRANCE.—I do not exactly remember—about two or three weeks before the accident.

Mr. HOLGATE.—Did you notice anything else in connection with the bridge that was out of order?

Mr. LAFRANCE.—No.

Mr. HOLGATE.—We want you—we order you to go on the ground to-morrow, and in company with Mr. Kinloch and Mr. McLure, endeavour to find that plate.

Mr. LAFRANCE.—Yes.

Mr. HOLGATE.—We want you to stay until you find that plate or make sure of something and appear here on Friday morning and resume your evidence.

Mr. LAFRANCE.—Yes.

Mr. HOLGATE.—You are still under subpœna and it is compulsory for you to be here.

Mr. LAFRANCE.—Yes.

Witness retired.

DONAT NADEAU, sworn.

Prof. KERRY.—Have you been working for the Phœnix Bridge Company?
Mr. NADEAU.—Yes, sir.
Prof. KERRY.—For how long?
Mr. NADEAU.—About a month.
Prof. KERRY.—In what position?
Mr. NADEAU.—As a painter.
Prof. KERRY.—At what part of the bridge?
Mr. NADEAU.—At every part of the bridge where there was painting to be done.
Prof. KERRY.—Were you working on the 29th August?
Mr. NADEAU.—I worked till a quarter to three in the afternoon.
Prof. KERRY.—Why did you stop?
Mr. NADEAU.—On account of wind.
Prof. KERRY.—Were you there when the bridge fell?
Mr. NADEAU.—No, I was down home.
Prof. KERRY.—Did you see any part of the bridge out of order?
Mr. NADEAU.—No.
Prof. KERRY.—It was all safe and sound?
Mr. NADEAU.—I never noticed anything wrong or broken.
Prof. KERRY.—Did you hear anyone say that anything was wrong?
Mr. NADEAU.—Yes.
Prof. KERRY.—Who told you?
Mr. NADEAU.—Some of my work mates—the fellows working with me.
Prof. KERRY.—You do not know who?
Mr. NADEAU.—Yes, Joe Biron.
Prof. KERRY.—And the others?
Mr. NADEAU.—I do not remember any others who spoke to me about it.
Prof. KERRY.—Is Joe Biron alive?
Mr. NADEAU.—No, he was killed.
Prof. KERRY.—What did he say?

Mr. NADEAU.—The night before the day that the bridge fell I, Joe Biron and others working on the bridge were talking about the bridge and they agreed that there was something wrong.

Mr. STUART.—That is not what he said, is it?

Mr. NADEAU.—They were speaking about the work concerning the bridge and Biron said there was something broken in the bridge—a plate cracked.

Prof. KERRY.—In what place?
Mr. NADEAU.—Biron said that it was near the pier.
Prof. KERRY.—You do not know the exact place?
Mr. NADEAU.—No.
Prof. KERRY.—Was it on the pier or on one of the chords?
Mr. NADEAU.—I could not say.
Prof. KERRY.—You have never seen anything yourself?
Mr. NADEAU.—No, never.
Prof. KERRY.—Do you know that Biron saw it?
Mr. NADEAU.—I could not say.
Mr. HOLGATE.—Do you know anything of your own knowledge?
Mr. NADEAU.—No.

Prof. GALBRAITH.—You said that you did not work after three o'clock on account of the wind?

Mr. NADEAU.—Yes.

Prof. GALBRAITH.—Was there more wind than usual that afternoon?

Mr. NADEAU.—No.

Prof. GALBRAITH.—You had often worked on the bridge when the wind was as strong?

Mr. NADEAU.—Yes.

Witness discharged.

Mr. A. B. MILLIKEN, recalled.

Prof. KERRY.—You had full charge of the erection of the bridge?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—What was the last date that you were at the structure previous to its fall?

Mr. MILLIKEN.—The morning of August 26th.

Prof. KERRY.—That would be the Tuesday of the week?

Mr. MILLIKEN.—Monday.

Prof. KERRY.—The brilge fell on Thursday?

Mr. MILLIKEN.—It fell on Thursday the 29th.

Prof. KERRY.—For how many days at that time had you been in the vicinity of the structure?

Mr. MILLIKEN.—From August 6th to August 26th.

Prof. KERRY.—You were there continuously between those dates?

Mr. MILLIKEN.—Yes, sir; that is I had been out to Belair.

Prof. KERRY.—But you were at Quebec?

Mr. MILLIKEN.—In the vicinity of the work.

Prof. KERRY.—In touch with the work?

Mr. MILLIKEN.—Yes.

Prof. KERRY.—Will you tell us what definite information you have about defects?

Mr. MILLIKEN.—I have not any definite information about defects.

Prof. KERRY.—Were no reports of those bulges brought to you at all?

Mr. MILLIKEN.—Yes, sir; I left for Phœnixville on the morning of August 26, I reached Phœnixville on the evening of August 28, and on the morning of Aug. 29, after I had gone down to the office at Phœnixville, there was a letter there from Mr. Yenser dated August 27, from Liverpool at the bridge. In that letter he indicated that a chord section was slightly bent and wanted to know whether he should continue to work on the suspended span or simply work on the removal of the main traveller and asked a reply from our office by wire. He was called up on long distance telephone, and I talked with him about a quarter of ten on the morning of August 29, and referring to his letter of August 27 I asked him whether he had stopped the erection or whether he was proceeding with it. His reply to me over 'phone was that he was going ahead and that everything was all right. I said: Have you moved the forward traveller? He said: Yes, moved it yesterday morning. And he further said that he had one of the temporary track girder spans in place and was about to swing the second one into place. I said: Is Mr. Birks there? He said: Yes. I said: Mr. Deans wants to speak to him. That was about all that was said between Mr. Yenser and myself. Then Mr. Deans talked with Mr. Birks following my conversation with Mr. Yenser.

Prof. KERRY.—That is to say that Mr. Yenser wrote drawing the attention of the office on the 27th and asking for specific instructions?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—And then proceeded to advance the traveller without waiting for a reply to that letter?

Mr. MILLIKEN.—Yes, sir. He asked a reply by wire, and instead of wiring we called him by 'phone, long distance 'phone.

Prof. KERRY.—At what time would it have been reasonable for him to have had a reply by wire to that letter ?

Mr. MILLIKEN.—At that time there was considerable trouble in transmission of telegrams. It was very uncertain, in fact they accepted all telegrams subject to delay on account of having trouble with the operators.

Prof. KERRY.—The letter would have reached Phœnixville at what time ?

Mr. MILLIKEN.—I think the letter reached Phœnixville about 9.15 in the morning. That is the usual time for our Quebec mail to reach Phœnixville, on the second delivery in the morning.

Prof. KERRY.—It takes about 36 hours for mail to be delivered ?

Mr. MILLIKEN.—Yes, sir, a letter mailed here—we have all our mail posted in the evening, coming down from work; that mail will reach Phœnixville or should day after to-morrow morning on the second delivery about 9 o'clock or 9.15 o'clock.

Prof. KERRY.—So that Mr. Yenser wrote a letter asking for specific instructions and then proceeded without waiting for a reply 24 hours before he could have reasonably expected in any case to have got a reply?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Did he indicate to you in your conversation that he took that step on the advice of anyone ?

Mr. MILLIKEN.—No, sir, he said that he considered everything all right and was going ahead and I then asked him these questions, where the forward traveller was, and he said he moved it yesterday morning and then he followed in saying that he had the first temporary track girder span placed and was about to place the second span of temporary track girders.

Prof. KERRY.—But he did not indicate that he had discussed the matter with anyone in the interval ?

Mr. MILLIKEN.—I do not know whether he had; it was reasonably certain he had discussed it with Mr. Birks, particularly with Mr. Birks he might have discussed it with.

Prof. KERRY.—You have no information ?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—One way or the other on that point ?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—Then he proceeded without getting instructions practically, even after the telephone conversation with you ?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—In that conversation he indicated to you that he no longer required instructions on the point he had written about?

Mr. MILLIKEN.—He said everything was all right and he was going ahead.

Prof. KERRY.—Previous to that date of your leaving Quebec, your attention had not been drawn to those chords in any way ?

Mr. MILLIKEN.—Not a single time; no, sir.

Prof. KERRY.—Nor to any other structural defect ?

Mr. MILLIKEN.—No, sir, not by anyone. I usually saw Mr. Yenser and all of his assistants, as many of the other bridge men as I came in contact—when I left. I did that morning, the morning of August 26. I left in my usual way and there was not a word indicating that there was even a suspicion of anything being wrong with any part of the bridge or material.

Prof. KERRY.—Now, we had some evidence to the effect that the ribs of the different chords would be found not to line up correctly when the bottom cover plate was removed. Was that an unusual occurrence ?

Mr. MILLIKEN.—Nothing at all unusual. It has been often done. Where the ribs of a chord join, the surfaces were not exactly one with the other, and they

would either be wedged into their proper position or jacks would be used to push them in.

Prof. KERRY.—But it was a more or less frequent occurrence to find that when the joint was uncovered?

Mr. MILLIKEN.—Yes, sir, in placing the chords it often occurs that one chord does not come in perfect contact with the edges, you know, and then they will be put in position afterwards, and especially with such heavy members.

Prof. KERRY.—You mean that is customary practice outside the Quebec construction?

Mr. MILLIKEN.—Yes, sir, we have that often.

Prof. KERRY.—Would it be possible to erect those members without that procedure?

Mr. MILLIKEN.—I do not think it would, especially in the Quebec chords, where they are on such an inclination. When you lay them on the camber blocking, and if the camber blocking was not true to the chord in placing it, it might shift slightly, a very little bit, and that would throw it out of square with its adjoining section.

Prof. KERRY.—Would not the bolting up of the bottom cover plate bring that almost correct?

Mr. MILLIKEN.—It might and it might not.

Prof. KERRY.—If you got full sized bolts in it would.

Mr. MILLIKEN.—Full sized bolts, the full size of the hole might do it.

Prof. KERRY.—How soon after the placing of the chord were these members usually straightened up?

Mr. MILLIKEN.—Well, the chords of this bridge they were placed according to the diagram furnished by our engineers at Phœnixville and the joints of all of them were expected to be opened and they were. That is the chord was set higher than its permanent position in the bridge after it was swung clear of its false work, and in doing that it might occur that we could not get these ribs exactly to bear one with the other on its side surfaces, and when that occurred the only thing to do was to push it into its proper position or to pull it there.

Prof. KERRY.—As I understand it, when the chord number was set in place then the upper and lower cover plates went on, did they not?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Now, how much of a play would that allow in the side sections of the chords?

Mr. MILLIKEN.—Well, in some cases we had to use a very small bolt in a $\frac{15}{16}$ hole. The joint was that much distorted and open that we could not put in—I think there were $\frac{7}{8}$ bolts used in some of the holes.

Prof. KERRY.—That would allow for a play of about $\frac{1}{8}$ of an inch, would it not?

Mr. MILLIKEN.—Yes, sir, there was no play there, the bolt went in tight; it was on account of the joint having been opened at the top and in contact at the bottom.

Prof. KERRY.—But in addition to being opened, the joint would be out of line, would it not?

Mr. MILLIKEN.—It might be slightly out of line, yes, sir.

Prof. KERRY.—Normally it would be held in line by the cover plate on top.

Mr. MILLIKEN.—The cover plate on top and its side connection plates.

Prof. KERRY.—You had no exceptional difficulties in any of these joints?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—How long did the anchor span remain on the false work?

Mr. MILLIKEN.—It remained on the false work about the middle of 1906.

Prof. KERRY.—About July, 1906?

Mr. MILLIKEN.—August.

Prof. KERRY.—Was the cantilever arm well under way at that time?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—How far would it be out before the removal of the false work commenced?

Mr. MILLIKEN.—The anchor arm commenced to work itself free of the false work under it and was practically free of it in the last of August of last year, and we had about eight or nine panels erected.

Prof. GALBRAITH.—Eight or nine panels?

Mr. MILLIKEN.—Eight panels of the cantilever arm.

Prof. GALBRAITH.—About the last of August?

Mr. MILLIKEN.—I cannot say that definitely; our progress reports will show that exactly.

Prof. KERRY.—Up to that date, were any of the joints riveted up, the main chord joints?

Mr. MILLIKEN.—August of 1906?

Prof. KERRY.—Up to the time that you got free of the false work?

Mr. MILLIKEN.—I think not.

Prof. KERRY.—They were all bulged?

Mr. MILLIKEN.—All bulged, yes, sir.

Prof. KERRY.—And had they come fairly well into position?

Mr. MILLIKEN.—Fairly well, yes, sir. In fact I did not examine the joints myself, Mr. Kinloch can answer that. He examined them all.

Prof. KERRY.—You waited for Mr. Kinloch's report?

Mr. MILLIKEN.—I talked with Mr. Yenser and Mr. Kinloch about it and asked how the joints were going and they would report. I talked to Mr. Kinloch about it, just in a general way.

Prof. KERRY.—And the joints would not be riveted up until they were satisfied they were bearing properly.

Mr. MILLIKEN.—We never riveted any of the joints until Mr. Kinloch and Mr. McLure were satisfied that the joint was in proper position to rivet.

Prof. KERRY.—In the lining process of the different members, that process took place just previous to riveting?

Mr. MILLIKEN.—The lining, I am not sure that I understand.

Prof. KERRY.—When you were lining out ribs of the chords which were not true?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—You had that done generally just previous to the riveting?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—That would not be bothered with up to that time?

Mr. MILLIKEN.—No, sir, I am not sure of that, it might have been lined up before.

Prof. KERRY.—Well, the definite instructions from Phœnixville, which are all a matter of record, will they cover such things as the removal of the false work?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—The instructions as to removing that at a certain date?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—So that the method would have been to report the condition to Phœnixville and then for Phœnixville to send instructions that a certain step should be taken?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—So that practically everything bearing on what was done, is in the erection instructions?

Mr. MILLIKEN.—In the erection instructions, yes, sir.

Prof. KERRY.—Would you consider, Mr. Milliken, that every step of that erection could be correctly traced out through those instructions?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Will you arrange to have a set of these filed, for the use of the Commission, please?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Have you them with you?

Mr. MILLIKEN.—No, not all of them.

Prof. KERRY.—We understand, Mr. Milliken, that the official papers of the bridge company bearing directly upon the erection consist of the erection instructions and the daily reports of Mr. Yenser.

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Those two series cover all the records that are regularly kept?

Mr. MILLIKEN.—In connection with the erection, yes, sir.

Prof. KERRY.—Is there a full file of the correspondence between the Phœnix Bridge Company and Mr. Yenser?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Here at present?

Mr. MILLIKEN.—Well, no, I thought you simply asked for the correspondence from Phœnixville after August 1 up to the time of the accident.

Mr. HOLGATE.—Were copies of the letters that Mr. Yenser wrote to Phœnixville kept in the office letter book at the Quebec bridge?

Mr. MILLIKEN.—Yes, sir.

Mr. HOLGATE.—Is that letter book there?

Mr. MILLIKEN.—Yes, sir.

Mr. HOLGATE.—I suppose all these communications will be to Mr. Yenser and not to Mr. Birks?

Mr. MILLIKEN.—In the first place to Mr. Yenser.

Mr. HOLGATE.—Will there be any to Mr. Birks.

Mr. MILLIKEN.—There has been some correspondence with Mr. Birks.

Mr. HOLGATE.—Anything of that nature between the office and Mr. Birks we would like to have just to go through it and see if there is anything that will bear on the information we are seeking?

Mr. MILLIKEN.—Mr. Birks' correspondence. I gave him authority to use my name in correspondence to Phœnixville, or his own.

After some discussion a book of plans was produced by Mr. Milliken, filed and marked as Exhibit 30. A book was produced by Mr. Milliken, filed and marked as Exhibit 31.

Prof. KERRY.—Would you indicate to us, Mr. Milliken, as nearly as you can, what material would have been on the bridge at the time of the accident, either actual bridge members which were not placed——?

Mr. MILLIKEN.—What material would have been on the bridge?

Prof. KERRY.—Yes?

Mr. MILLIKEN.—I do not quite understand.

Prof. GALBRAITH.—What material was on the bridge?

Mr. HOLGATE.—Not erected?

Prof. KERRY.—Or not necessarily for erection, it may have been just erection material?

Mr. MILLIKEN.—Of the permanent structure?

Prof. KERRY.—In addition to the permanent structure, not erected?

Mr. MILLIKEN.—Nothing except our working platform, consisting of planks and the necessary attachments for handling, and plates in position, the permanent members of the suspended span.

Prof. KERRY.—There was this small traveller, which we understand was on the third panel?

Mr. MILLIKEN.—The small traveller was in position on the third panel erected of the suspended span. The large traveller covered the ninth panel of the cantilever arm with its upper overhang and the lower front or end of it removed.

Prof. KERRY.—Removed off the bridge?

Mr. MILLIKEN.—Removed off the bridge, yes, sir; together with all of the wooden sheave beams and a great deal of other rigging from the top of the main traveller.

Prof. KERRY.—So that practically there was no loose material on the bridge at all?

Mr. MILLIKEN.—No loose material, no, sir, other than what was necessary for the actual work to be done.

Prof. KERRY.—No main truss members sent in advance of erection? I understand your method was that a member went down on the cars and went straight from the cars into the structure?

Mr. MILLIKEN.—Well, the main truss members that were required to be put into position were usually held back until they were wanted right in the front or at the point of erection. They might be held south of the office on the track, or they might be held on the south bridge span, or they might be set up on the anchor arm. We did that on account of the danger of something dropping in the removal of the traveller on the locomotive or material. It was hardly ever moved to the front of the bridge until it was wanted to place the attachments on it, to place it in position.

Prof. KERRY.—And actually there was no such material forward at the time of the accident except what was just going to be put up?

Mr. MILLIKEN.—From the investigation I made in my judgment there was none.

Prof. KERRY.—And all the loose material from the traveller, with small exceptions, had been lowered to the ground?

Mr. MILLIKIN.—Yes, sir.

Prof. KERRY.—And there was no track material of any kind?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—Will you arrange to have prepared and filed with the Commission a diagram of the bridge showing the exact load that was on it?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—At the moment of the accident?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—That will include, of course, the weight itself of the actual members erected and the weights and positions of all the erection material that was at that time on the structure?

Mr. MILLIKEN.—Yes, sir.

Prof. GALBRAITH.—Could you from memory, Mr. Milliken, state the main members of the anchor arm which were not completely riveted up at the time of the accident? I have a plan here showing the progress, the state of progress on August the 29th, and I can assist your memory by this plan.

(Plan produced, filed and marked Exhibit No. 32.)

Mr. MILLIKEN.—When I left there I think there were two joints on the west chord of the anchor arm and two on the east chord of the anchor arm.

Prof. GALBRAITH.—This plan would not quite indicate that. Looking over the anchor span this progress diagram seems to show that chords 5 were still unriveted, chords 6 and 7 completed, riveted up, and the remaining panels to the centre pier not riveted. The question I wished to ask was what the special reason was for not finishing up the chords 5. They seem to have been left behind unfinished; the chords beyond them, the panels beyond them were completely finished. Was there any reason?

Mr. MILLIKEN.—No reason, unless the joint was not in proper contact, no reason because we should have had that riveted, we had plenty of riveters, and they were working out on the cantilever arm, and we were anxious to complete the riveting on the cantilever arm as rapidly as possible, because we wanted to go ahead and paint it and wanted all the riveting done before commencing painting.

Prof. GALBRAITH.—You know of no reason for that not being done?

Mr. MILLIKEN.—No, sir.

Prof. GALBRAITH.—Will a similar answer apply to the main panels containing the bottom chords 9 and 10 in the anchor arm?

Mr. MILLIKEN.—Yes, sir.

Prof. GALBRAITH.—The same reason or explanation will apply?

Mr. MILLIKEN.—No, sir.

Prof. GALBRAITH.—You know of no reason why those should not have been fully riveted up at the time of the accident?

Mr. MILLIKEN.—No reason except that.

Prof. GALBRAITH.—Can you tell from inspection now whether this is a correct progress diagram for the 29th of August (Exhibit 32)? The red lines indicate metal erected, the black lines indicate metal erected and riveted complete. It is perhaps difficult to do it in five minutes.

Mr. MILLIKEN.—It is correct.

Prof. GALBRAITH.—This plan, then, you say represents truly the condition of the work on the 29th of August?

Mr. MILLIKEN.—Yes, sir, except that not being riveted (indicating). I do not know if that is absolutely correct—the riveting as indicated there.

Prof. GALBRAITH.—Well, will you go over this; take this plan and show where it is wrong?

Mr. MILLIKEN.—I say I do not know of my own knowledge.

Mr. HOLGATE.—If you could furnish us with a statement showing the precise condition of the field riveting on each joint as existing on the 29th of August?

Mr. MILLIKEN.—We shall have to depend on Mr. Kinloch and Mr. McLure for that. Our foreman of riveters was Mr. Meredith.

Mr. HOLGATE.—A statement agreed on between Mr. Kinloch and Mr. McLure would, in your opinion, be correct?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—I notice in the wreck, Mr. Milliken, in regard to the connection between the stringers and floor beams, that the ends of certain of the railway stringers were punched for riveting to the floor beams, but the floor beams were riveted up without these holes being made any use of. What is the explanation of that? The vertical angle where say two floor beams came against the stringer, the vertical angle at the end of the floor beam at each end of the stringer was punched for riveting to the stringer, but not riveted up; only one stringer was riveted to the floor beam and the other was not.

Mr. MILLIKEN.—I presume that was probably an expansion, not a bolting hole.

Prof. KERRY.—If that was an expansion end, why were these angles punched for riveting in the first place? Would they not have been left without any rivet holes?

Mr. MILLIKEN.—The end stiffener angles?

Prof. KERRY.—Yes?

Mr. MILLIKEN.—If there were holes in there, I should imagine that is what they were for, unless the stringers you refer to were placed on temporarily; we had some stringers placed there temporarily. We were using the electric railway stringers for permanent structures, we had been using some stringers for carrying our main traveller.

Prof. KERRY.—Some of the stringers of the main structure were being used as part of the main traveller?

Mr. MILLIKEN.—In other words, the permanent metal floor of a portion of the anchor arm was not in places complete.

Prof. KERRY.—From whom will we secure a record of that?

Mr. MILLIKEN.—Our plans will indicate that.

Prof. KERRY.—The plans will indicate that?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—You recall Mr. Clark's evidence of Saturday, Mr. Milliken?

Mr. MILLIKEN.—I heard pretty nearly all of it, I think; yes, sir.

Prof. KERRY.—Would you have permitted that repaired chord to have been sent down to the bridge unless it was straight?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—Assuming that that chord was put into the bridge straight, what explanation can be offered of the deflection that was found in it?

Mr. MILLIKEN.—When you say straight, do you mean straight to a horizontal line?

Prof. KERRY.—Straight to a true horizontal line. It would be a very easy thing to see on a straight member of that kind, looking along the edge of it, a deflection of an inch.

Mr. MILLIKEN.—If I had seen a slight deflection, I would not have objected to it going in.

Prof. KERRY.—By a slight deflection, you would mean how much?

Mr. MILLIKEN.—Half an inch or three quarters of an inch in those long chord sections, in a long girder.

Prof. KERRY.—On such a deflection as was actually reported—Clark stated I think an inch and five-eighths, you would not have permitted that?

Mr. MILLIKEN.—Well, I would have reported the matter and consulted—I might have let it go in, but I would have conferred with Phœnixville immediately in regard to that.

Prof. KERRY.—As a matter of fact no such deflection was reported to you as being in the chord or was noticed by you at any time?

Mr. MILLIKEN.—Never, no, sir.

Prof. KERRY.—What explanation could you suggest or what force could have produced the deflection that is reported to have been measured?

Mr. MILLIKEN.—I do not know.

Prof. KERRY.—You would regard the occurring of such a deflection in a member that was originally straight, particularly in a member of these dimensions, as a most serious circumstance?

Mr. MILLIKEN.—If I had been absolutely certain that that member had been absolutely straight and that a deflection of that kind had occurred, why of course I would have been attracted by it and would no doubt have investigated it and watched it closely, but otherwise I should not have.

Prof. KERRY.—Would it be possible under the system of inspection that was existing for a defect of that nature to have passed through in such a way as to leave it open to question as to whether it existed or whether it did not?

Mr. MILLIKEN.—I am not thoroughly familiar with the rules of shop inspection.

Prof. KERRY.—So that so far as your own department is concerned, that member could have come down with that warp existing in it and not have been rejected?

Mr. MILLIKEN.—Yes, sir, after the material is shipped to us, we must assume it is all right unless it is damaged in transit.

Prof. KERRY.—Now this particular member could be said to have been damaged in transit?

Mr. MILLIKEN.—It was damaged in handling in our storage yard.

Prof. KERRY.—It can be considered to have been in transit?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—And it was actually repaired under your direction?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—So that if you had known there was any crookedness in the member at the time, it would have been made good?

Mr. MILLIKEN.—Certainly at the same time that the other repairs were made to it.

Prof. KERRY.—Could you express an opinion as to how near to failure a compression member of that shape would be when it had deflected under stress to the amount stated in Mr. Clark's evidence?

Mr. MILLIKEN.—No, sir, I could not.

Prof. KERRY.—Was there anyone present on the bridge who could have estimated that fairly?

Mr. MILLIKEN.—At the time of the accident?

Prof. KERRY.—At the time of the accident?

Mr. MILLIKEN.—Yes, sir, Mr. Birks; he had the stress sheets.

Prof. KERRY.—It is not a question of stress sheets, Mr. Milliken, it is a question of how serious a condition of a member that deflection indicated. You would have looked to Mr. Birks for advice on that point.

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Have we any record of Mr. Birks' position on that?

Mr. MILLIKEN.—On that chord section?

Prof. KERRY.—In regard to the member which was warped?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—In what form?

Mr. MILLIKEN.—In the sketch which he sent to the Phœnixville office.

Prof. KERRY.—That will be found in the correspondence?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—Do you understand that the evidence of Mr. Clark to the effect that Mr. Birks did not know whether that was a stress deflection or a construction deflection, is correct?

Mr. MILLIKEN.—Mr. Clark's understanding of it?

Prof. KERRY.—Mr. Clark stated that Mr. Birks claimed that that deflection was in the construction of the chord previous to its being placed in the bridge. Have we any record as to whether that statement of Mr. Clark is correct or not?

Mr. MILLIKEN.—None that I know of.

Prof. KERRY.—If you had been present on the ground, Mr. Milliken, and in full possession of the facts in regard to these members, would you have considered it safe to further load them?

Mr. MILLIKEN.—Yes, sir.

Mr. HOLGATE.—In considering the scheme for erection, particularly for the lower chord system, were the erection strains considered—I am speaking now from the erection point of view—as eccentrically delivered to the end of the chord sections or to be distributed?

Mr. MILLIKEN.—You mean the lower chords? Mr. Deans, I think, can explain that better than I can. I do not know anything about stresses.

Mr. HOLGATE.—Perhaps Mr. Deans can explain that. There is a point we want to clear up but we will reserve that question for Mr. Deans.

Porf. GALBRAITH.—Your visit extended from the 6th of August till the 26th, I think you said?

Mr. MILLIKEN.—Yes, sir.

Prof. GALBRAITH.—During that visit was your attention directed to any alleged dangerous parts in the bridge?

Mr. MILLIKEN.—Absolutely none.

Prof. GALBRAITH.—Did you visit any joints or other parts during that visit which you considered dangerous?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—Assuming a chord to have been perfectly straight when erected and to have subsequently deflected, how long, under the existing system of inspection, would such a defect have probably remained unobserved?

Mr. MILLIKEN.—In my judgment that is a very hard question to answer. I could not answer that question intelligently.

Prof. KERRY.—Would you say, then, that a close inspection of the erected members was considered to be the duty of the inspectors of the Quebec Bridge Company?

Mr. MILLIKEN.—Yes, sir, under the requirements of the field inspection by the Quebec Bridge Company?

Prof. KERRY.—And that the Phœnix Bridge Company depended on them to make that inspection?

Mr. MILLIKEN.—I cannot answer that.

Prof. KERRY.—Were the main members of the bridge under systematic inspection by the Phœnix Bridge Company?

Mr. MILLIKEN.—No, sir, not in the field.

Prof. KERRY.—What value did you place on the inspection by the Quebec Bridge Company?

Mr. MILLIKEN.—I placed the value upon them as inspectors that when we received it it was all right ready for erection.

Prof. KERRY.—I mean their field inspection.

Mr. MILLIKEN.—I thought the same of the field inspection as the shop inspection.

Prof. KERRY.—Were you depending on them to draw wour attention to any defect in the main members which might develop?

Mr. MILLIKEN.—Not entirely so; no, sir.

Prof. KERRY.—But you had no organized inspection of your own?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—Was the time required for the erection closely estimated, Mr. Milliken?

Mr. MILLIKEN.—The time for the erection?

Prof. KERRY. The time required to do the erection work. Had that been closely estimated?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—You had never endeavoured to lay out a time programme for the work?

Mr. MILLIKEN.—Yes, this season I expected to complete the south half of the suspended span, to practically complete the riveting of the cantilever and anchor arms, remove the main traveller and erect it on the north side and complete the north shore false work ready for erection next spring.

Prof. KERRY.—But you had no closely planned time scheme, for example, that such and such things were to be finished by August 1?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—And Mr. Yenser was not endeavouring to live up to the requirements of any such time scheme?

Mr. MILLIKEN.—No, sir.

Prof. KERRY.—At the time of the accident was the condition of progress better than your expectation, or otherwise?

Mr. MILLIKEN.—Well, it was about up to our expectation, though he had lost a good deal of time on account of bad weather this season.

Prof. KERRY.—So that he would be a little more than usually anxious to get the material up?

Mr. MILLIKEN.—Not necessarily so; no, sir.

Mr. DAVIDSON.—I do not know if Mr. Milliken is aware of this, but in connection with the question that Prof. Kerry has just put to Mr. Milliken, I may say that my information is that the Phœnix Bridge Company's officials were being continually urged, almost to the extreme limit, by the Quebec Bridge people to push the work forward this season.

Mr. DEANS.—I wish to deny that absolutely.

Mr. DAVIDSON.—I do not say that all the information I get is absolutely correct.

Mr. DEANS.—That is absolutely wrong.

Mr. DAVIDSON.—But it does happen that a good deal I have had is correct so far.

Mr. STUART.—Not all of it—not all you expected to be.

Mr. HOLGATE.—Do not argue about its correctness now; we will have Mr. Hoare explain that later.

Mr. STUART.—I do not think that either Mr. Milliken or Mr. Deans has been questioned about Mr. Yenser's competency.

Prof. KERRY.—Yes, that was earlier in the examination.

Mr. STUART.—It was not in Mr. Milliken's examination.

Prof. KERRY.—Mr. Deans was questioned in his evidence as to whether Mr. Yenser was competent.

Mr. STUART.—It was suggested that Mr. Yenser was subject to orders from various people, and I would like that matter cleared up by Mr. Milliken, and also that there was difficulty about getting men because of the supposed controversy on the subject of travelling expenses. I would suggest that these two points should be cleared up.

Mr. HOLGATE.—These points have both been answered.

Mr. STUART.—The last one has certainly not been.

Prof. KERRY.—The impression left in our minds by the statement in regard to Mr. Yenser was simply that he allowed himself to be influenced beyond his better judgment by other officials employed on the bridge.

Mr. STUART.—I think that is an entirely erroneous impression. That is the impression of a witness and nothing more.

Prof. KERRY.—We recognized it as such.

Mr. STUART.—I thought the opinion of a man who knew Mr. Yenser was worth something as correcting that impression as to whether he was likely to be influenced. I attach some importance to a statement that was made that there was a difficulty in getting men because of this controversy about travelling expenses, the statement in regard to which, I am instructed, was quite inaccurate. The controversy arose a great deal too late to affect the supply of bridgemen at all. It only arose at the time of the strike.

Prof. KERRY.—Have you had a satisfactory working force throughout the season?

Mr. MILLIKEN.—We have had a satisfactory force as far as the safety of the work is concerned, but in order to accomplish what we have outlined this year there, and on account of the unusual loss of time on account of bad weather this season we felt as though we had to increase our bridge men to the extent of 15 or 25 men, and that was partially the reason of my visit to Phœnixville under instructions of our chief engineer. On Saturday or Sunday prior to the accident I sent a bridge man out to secure men and he had already secured a number near Boston, of regular bridge erectors, and had them under orders to report at Quebec to Mr. Yenser. We had his telegram on Friday morning after the accident and we wired him to hold the men and report to Quebec before securing any more.

Prof. KERRY.—Up to the date of the accident you had been at any time able to hire the full working force you desired to employ?

Mr. MILLIKEN.—We had as many men as the work actually called for to carry it on, and with perfect safety, but in order to have it proceed more rapidly we thought, of course, to increase our force, and were arranging to do that.

Prof. KERRY.—Had you made previous unsuccessful efforts to increase your force?

Mr. MILLIKEN.—Well, we had made a number of efforts. On one occasion we paid the expenses of 22 bridge men out of New York, and when they arrived here there were only ten of them reported for duty, so that we lost twelve there which we had to replace, and we had twelve or fifteen come in from Buffalo, New York, and part of them also left without rendering any service whatever to the Bridge Company. The only thing for us to do——

Prof. KERRY.—Is that a usual happening?

Mr. MILLIKEN.—With that New York party it was rather an unusual thing to lose that percentage of the number. It is nothing unusual, when a party of fifteen or twenty-five bridge men are ordered to a point, that a few of them will drop out. But, we lost twelve out of twenty-two. We had paid their expenses from New York to Quebec.

Prof. KERRY.—Was there any explanation of that?

Mr. MILLIKEN.—Nothing that I had except some of them said that they had to walk too far to their boarding house, and various other excuses.

Prof. GALBRAITH.—Was this trouble that you are speaking of now about the 8th of August?

Mr. MILLIKEN.—No, that was in July, I think, that they were sent—June or July—I do not remember.

Prof. KERRY.—In case of a difference of opinion between Mr. Yenser and the engineers and the inspectors on the work, what were his instructions?

Mr. MILLIKEN.—Mr. Yenser had full control of the entire force employed on the work.

Prof. KERRY.—But he had not control of the inspectors of the Quebec Bridge Company?

Mr. MILLIKEN.—No, sir; only the Phœnix Bridge Company's employees.

Prof. KERRY.—In case of a difference of opinion between these gentlemen, what were his instructions?

Mr. MILLIKEN.—If there was a difference of opinion he would have discharged the man or reported it to Phœnixville. I cannot answer what he would have done, but he would have done one of the two things.

Prof. KERRY.—I do not mean by a difference of opinion, necessarily a quarrel or dispute, Mr. Milliken. The question is as to what was the proper procedure. He might consider one thing to be better to do and the engineer on the work might consider another thing was the better to do.

Mr. MILLIKEN.—In a case of that kind I suppose they would have to arrive at some agreement, or he would have to report it to the Phœnixville office, or wire, or telephone.

Prof. KERRY.—But he had authority to decide these points himself?

Mr. MILLIKEN.—He had authority to decide these matters himself. Yet, Mr. Yenser was a man who would never take advantage of authority. He was very conservative.

Prof. KERRY.—And was he very careful?

Mr. MILLIKEN.—Very careful, and would not take extreme measures simply because he was placed in authority.

Prof. KERRY.—On the other hand, was he a man who had a very considerable reliance on his own judgment?

Mr. MILLIKEN.—Yes, sir.

Mr. ROY.—There is one point that does not seem very clear as regards the inspection. I might suggest that you ask the witness whether or not it was the custom for the foreman of the Phœnix Bridge Company to examine all erected members all over the bridge, and then report to the superintendent of the work, Mr. Yenser. I think there is some confusion about the inspection. Maybe I have missed some part of the evidence; the question does not seem very clear from Mr. Milliken's evidence.

Prof. KERRY.—I think, Mr. Roy, that that question would be answered by a question that I asked Mr. Milliken. You remember we asked him explicitly if he had any systematic method of inspection of the members in the structure by the force of the Phœnix Bridge Company, and he said that he had not. That, I think, would be a direct answer to your question.

Mr. ROY.—Yes, although I think that the foreman used to examine the work already done. Of course, if you are satisfied the point is clear enough, I do not want any more.

Mr. HOLGATE.—I think I see what Mr. Roy means. The question was asked him here :

'Where did Mr. Yenser's reports go ?

'Mr. MILLIKEN.—They went to Phœnixville addressed to the Phœnix Bridge Company. We have some regular forms for reporting the number of rivets driven per day, and our car reports which were made up by the clerks in the office and simply signed by Mr. Yenser.' Possibly these reports would throw light on something Mr. Roy wants.

Mr. ROY.—The point I want to get at is this : From whom was the information necessary to Mr. Yenser to make these reports gathered ? Who supplied Mr. Yenser with the information necessary to send the reports to Phœnixville ? His foreman of riveters—Meredith ?

Prof. KERRY.—It has been stated, Mr. Milliken, that some of the members of the bridge were in a railroad wreck between Phœnixville and Quebec. Have you any record of that ?

Mr. MILLIKEN.—Yes, sir.

Prof. KERRY.—What members were those ?

Mr. MILLIKEN.—I do not remember. We have a record though, we can let you have it.

Prof. KERRY.—What became of the members?

Mr. MILLIKEN.—They were repaired. They were minor members. I do not remember exactly what they were.

Prof. KERRY.—I think it would be well to submit a statement in regard to that. It might be a written statement which need not be a matter of evidence.

Mr. MILLIKEN.—It was in 1905.

Witness retired.

E. A. HOARE, recalled.

Mr. HOLGATE.—Will you please put in as exhibits plans of the bridge ? Are they in three packages ?

Mr. HOARE.—In three folios.

Mr. HOLGATE.—Do they contain the working plans of the bridge ?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And strain sheets ?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Certified copies?

Mr. HOARE.—Certified by Mr. Cooper and the engineer of the Department of Railways and Canals.

Mr. HOLGATE.—And these plans are all the information in the shape of plans that you have ?

Mr. HOARE.—Yes, sir. Here is the index. (Folios of plans and index put in and marked Exhibits Nos. 33A, 33B, 33C and 33D.)

Commission adjourned to meet at ten a.m., Tuesday, September 17.

EIGHTH DAY.

QUEBEC, TUESDAY, September 17, 1907.

The Commission visited the lodgings in St. Joseph de Levis of Mr. Delphis Lajeunesse who, owing to his injuries, was unable to attend in response to the subpœna :—

Mr. LAJEUNESSE being sworn:

Mr. HOLGATE.—Were you employed by the Phœnix Bridge Company?

Mr. LAJEUNESSE.—Yes, sir.

Mr. HOLGATE.—When did you start work for them?

Mr. LAJEUNESSE.—In July, about the 23rd. I came down on the 22nd and started the day after. We started on Wednesday.

Mr. HOLGATE.—Of this year?

Mr. LAJEUNESSE.—Yes, sir.

Mr. HOLGATE.—Were you continuously at work?

Mr. LAJEUNESSE.—Yes, sir.

Mr. HOLGATE.—What were you working at?

Mr. LAJEUNESSE.—I worked at every place on the bridge. I did everything—erection man, raising gang and riveters' gang.

Mr. HOLGATE.—Who was your foreman?

Mr. LAJEUNESSE.—I do not know his name. They called him Slim.

Prof. KERRY.—Meredith is his name?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—You were working in the riveting gang?

Mr. LAJEUNESSE.—Yes, in the riveting gang. I worked about two weeks in the riveting gang.

Mr. HOLGATE.—Were you working on the day of the accident to the bridge on the riveting gang?

Mr. LAJEUNESSE.—No, not on the riveting gang. We just fitted up some riveting braces.

(The witness was shown plan marked Exhibit No. 26.)

Mr. HOLGATE.—Do you remember at what part of the bridge you were working on the 29th of August?

Mr. D. LAJEUNESSE.—I stood right there.

Mr. HOLGATE.—That is the point marked L on Exhibit 26? What were you doing at that point?

Mr. D. LAJEUNESSE.—On that buckskin. We put two braces in the centre and one at each end. We put the bolts down from the top chord to the bottom chord.

Mr. HOLGATE.—What is a buckskin?

Mr. D. LAJEUNESSE.—A box brace.

Mr. HOLGATE.—Was this joint at L completely riveted up?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—At that time?

Mr. D. LAJEUNESSE.—Yes, sir.

Mr. HOLGATE.—Had you been working on the chords?

Mr. D. LAJEUNESSE.—I was working on the bottom of the chords at the centre posts—not on the chords. I went down on the chord. I worked just on the centre posts just putting some screw bolts in.

Mr. HOLGATE.—On the lower section of the centre posts?

Mr. D. LAJEUNESSE.—Yes, I worked on both sides. The last day I worked was on the Montreal side.

Mr. HOLGATE.—What were you doing there?

Mr. D. LAJEUNESSE.—Putting in some screw bolts. I was working on the chords with the riveters' gang on the Montreal side.

Mr. HOLGATE.—On the chords on the Montreal side of the bridge?

Mr. LAJEUNESSE.—Yes.

Mr. HOLGATE.—At the joint between chords 9 and 10?

Mr. D. LAJEUNESSE.—Yes. I was working about four days before the accident in the riveters' gang there with Alexander Beauvais.

Prof. GALBRAITH.—On the Montreal side?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Was that at the splice between 9 and 10 you were working?

Mr. D. LAJEUNESSE.—No, right in the post. Down that post you have a small plate. About ten riveters were working down that plate.

Mr. HOLGATE.—You started in the middle of chord 9 and went down to the middle of chord 10?

Mr. D. LAJEUNESSE.—Yes, just the row of rivets.

Mr. HOLGATE.—You were riveting?

Mr. D. LAJEUNESSE.—No, I was bucking up. On the morning before the accident I was working on the lower chord.

Mr. HOLGATE.—At the joint or on the chord?

Mr. D. LAJEUNESSE.—On top of the chord.

Mr. HOLGATE.—On the top of the chord at panel point No. 5 on the cantilever arm?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Was Mr. McCumber working there?

Mr. D. LAJEUNESSE.—I was just reaming some holes.

Mr. HOLGATE.—Were these holes in the bottom of the chord?

Mr. D. LAJEUNESSE.—Yes, right on the side of the chord.

Mr. HOLGATE.—On the underneath side?

Mr. D. LAJEUNESSE.—No, on the side.

Mr. HOLGATE.—Was that on some splice plates?

Mr. D. LAJEUNESSE.—Yes, some plates. I passed the reamer through three plates. I was working there at two o'clock.

Mr. HOLGATE.—You stopped working at that point at two o'clock on the day before the accident?

Mr. D. LAJEUNESSE.—No, on the same day. After leaving panel point 5 of the cantilever arm I went back to point J on the anchor arm, completed my work there and moved forward to point L, already referred to, and was at point L when the accident to the bridge took place.

Mr. HOLGATE.—Did you notice anything particular when the accident took place, or what did you notice first?

Mr. D. LAJEUNESSE.—I noticed something around here (indicating).

Mr. HOLGATE.—No, but just when the accident took place?

Mr. D. LAJEUNESSE.—I was on top just putting a turn on the rope to send up a box of bolts when I saw something jerk the bridge like that (indicating). I fell down in my box, stood up, fell down again, and I looked again. I thought the traveller had fallen down on the bridge. The traveller was in the same place. I came to this side of the bridge and I looked, and when I saw the bridge go down in that way I was on that chord, and I thought that chord made the bridge fall.

Mr. HOLGATE.—Was the first motion you felt on the bridge a jerking towards the river or was it a falling downwards?

Mr. D. LAJEUNESSE.—No, everywhere; it gave me a jerk towards the river. I was thrown six feet on the buck brace.

Mr. HOLGATE.—Which side of the bridge were you on?

Mr. D. LAJEUNESSE.—I was on the Montreal side of the bridge. I had just set the bolts down and the bridge fell down. I was just making a turn with the rope on the anchor arm, and my brother was waiting for me for the bolts, and he said you have not time to send them down, it is pretty near time to quit, and then the bridge went down.

Mr. HOLGATE.—Did you fall from L to the deck?

Mr. D. LAJEUNESSE.—No, I stood right in my place. Nothing came on top of me.

Mr. HOLGATE.—You stood at point L until it reached the ground?

Mr. D. LAJEUNESSE.—Yes, I remember everything. The first thing after I was down there I was looking at something coming up again, and after I got down there I just jumped about twenty feet. When I got down there I saw my brother. I saw some blood coming out. I was the first to come out, my brother was the second one, and the rest came out after me.

Mr. HOLGATE.—What did you observe at the time of the accident as to the manner in which the bridge fell? Do you remember distinctly what you observed at that time? You were on the Quebec side?

Mr. D. LAJEUNESSE.—No, I was on the Montreal side.

Mr. HOLGATE.—Yes, on the Montreal side. Can you remember what you observed at the time?

Prof. KERRY.—He was jerked and he was thrown six feet on the buck brace.

Mr. HOLGATE.—Jerked towards the river?

Mr. D. LAJEUNESSE.—I did not fall down outside the bridge. It just caught me. I think it was on the deck. I thought it was the traveller coming down.

Prof. KERRY.—It threw you outside towards the bridge?

Mr. D. LAJEUNESSE.—It threw me outside to the box brace. I was standing up on the box and it knocked that box down. I fell down in the box, and I stood up and looked to see what was the matter. I thought it was the big traveller down. When I saw the traveller in the same place I looked inside and I saw the brace go to the Quebec side. I said, 'Well, I am finished,' and I thought so.

Prof. KERRY.—Then the bridge fell down towards the Quebec side?

Mr. D. LAJEUNESSE.—Yes. But I stood there; nothing came over on me. When I saw the post come down I thought it was coming down on top of me, but it did not.

Prof. KERRY.—Could you see where it broke first?

Mr. D. LAJEUNESSE.—I never saw anything broke. I saw where it was crooked.

Prof. KERRY.—You did not see where it was broken?

Mr. D. LAJEUNESSE.—I saw something a couple of days before the accident. Every man on the bridge in the morning said, 'Go and see that.' About eight feet from that post (indicating on plan) going up was crooked outside on the Quebec side.

Mr. HOLGATE.—Eight feet beyond panel point No. 10, in the cantilever arm, chord 9, on the Quebec side. You might just describe what you saw here. First of all, when did you see it?

Mr. D. LAJEUNESSE.—A couple of days before the accident—when I was working at the centre post. I went down at that place. I never saw that before that day.

Mr. HOLGATE.—What was the first time before that you went down and you did not see it?

Mr. D. LAJEUNESSE.—About six days before.

Mr. HOLGATE.—You did not see it then?

Mr. D. LAJEUNESSE.—No, I did not see anything then. When I saw those bridge men going and looking, it gave me a scare and I wanted to quit after I saw it.

Mr. HOLGATE.—The first time you saw it, was when?

Mr. D. LAJEUNESSE.—Monday or Tuesday.

Mr. HOLGATE.—Was anybody with you?

Mr. D. LAJEUNESSE.—Yes, every bridge man on the bridge. My brother was on the bridge and I asked him: What the hell are you looking at, and when he told me I said, By God.

Mr. HOLGATE.—Just tell us what it was you saw?

Mr. D. LAJEUNESSE.—It was about 2 inches crooked.

Mr. HOLGATE.—Was it bent sideways?

Mr. D. LAJEUNESSE.—It was crooked, curved or bulged towards the Quebec side.

Mr. HOLGATE.—That was the chord, was it?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—These chords have four plates?

Mr. D. LAJEUNESSE.—These four plates were crooked.

Mr. HOLGATE.—Was that bent part long or short?

Mr. D. LAJEUNESSE.—Just short. It was about two or three feet long and one or two inches bulge. I could see it by the eye on top of the bridge.

Mr. HOLGATE.—That bend was here (indicating) on the Quebec side?

Mr. D. LAJEUNESSE.—Yes.

Prof. GALBRAITH.—Is he speaking of the ribs or the splice plates?

Prof. KERRY.—The ribs.

Prof. GALBRAITH.—Of the four ribs simply?

Mr. D. LAJEUNESSE.—Yes.

Prof. GALBRAITH.—Close to the cover plate ?

Mr. D. LAJEUNESSE.—Yes.

Prof. KERRY.—And all bent towards Quebec ?

Mr. D. LAJEUNESSE.—Yes.

Prof. KERRY.—When that bend took place were the cover plates there or were the lacing angles in ?

Mr. D. LAJEUNESSE.—You have a cover plate on top about a foot above this place. It was about two feet away from the cover plate.

Prof. KERRY.—Was that on Monday or Tuesday ?

Mr. D. LAJEUNESSE.—One of these two days.

Mr. HOLGATE.—But you do not remember.

Mr. D. LAJEUNESSE.—I do not remember.

Mr. HOLGATE.—You brother was with you then ?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Who else ?

Mr. D. LAJEUNESSE.—All the bridge men were on top. I was the last man on the top of the bridge and I saw all the men looking, and I asked : What is the matter, and he said : Can you see that bottom chord ?—it is crooked. I said : By God, I am going home before some accident.

Prof. KERRY.—That was when ?

Mr. D. LAJEUNESSE.—Seven o'clock in the morning.

Prof. KERRY.—That would be Tuesday morning ?

Mr. HOLGATE.—Most likely seven o'clock Tuesday morning.

Mr. D. LAJEUNESSE.—We had not started work when we saw this—five minutes before seven.

Mr. HOLGATE.—But you went ahead and worked ?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—You went to work at panel point No. 5 ?

Mr. D. LAJEUNESSE.—No, I was working there at that time.

Mr. HOLGATE.—How did you get there ?

Mr. D. LAJEUNESSE.—I walked over the track to some place near panel point No. 6 and walked along the chord to the cantilever pier.

Mr. HOLGATE.—Do you recollect at this place, on chord 9, that you spoke of, if the top cover plate was on and riveted up ?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Was the bottom cover plate riveted up ?

Mr. D. LAJEUNESSE.—Yes, all riveted up.

Mr. HOLGATE.—Was this joint all made up ?

Mr. D. LAJEUNESSE.—Yes, all finished. A couple of weeks before we were moving that scaffold.

Mr. HOLGATE.—That is at panel point 9 several days before that you moved away the scaffold ?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—The scaffold was there for the purpose of finishing up the joint of chord No. 8?

Mr. D. LAJEUNESSE.—It was all finished.

Mr. HOLGATE.—Was the bottom plate in place on chord 8?

Mr. D. LAJEUNESSE.—Yes, it was in place, and riveted, too.

Mr. HOLGATE.—Did you notice anything else on any of these chords?

Mr. D. LAJEUNESSE.—No, I did not see anything else.

Mr. HOLGATE.—Did you notice the joint at this place here on chord 8 which is marked 'joint' on the plan?

Mr. D. LAJEUNESSE.—No.

Mr. HOLGATE.—Did you hear anything spoken about that joint on chord 8 at that time?

Mr. D. LAJEUNESSE.—No.

Mr. HOLGATE.—The only joint that was spoken about was one on chord 9?

Mr. D. LAJEUNESSE.—On chord 9, that is all.

Prof. GALBRAITH.—They are both on chord 9.

Mr. HOLGATE.—Is the place where you saw the bulge in this panel (indicating) between the figures 9 and 10?

Mr. D. LAJEUNESSE.—Nearer towards point 10.

Mr. HOLGATE.—Then do I understand that you saw nothing out of order in panel 8?

Mr. D. LAJEUNESSE.—No, I did not see anything.

Prof. GALBRAITH.—What day was that?

Mr. HOLGATE.—At seven o'clock on the Tuesday before the accident.

Mr. D. LAJEUNESSE.—The whistle blows five minutes before the work begins.

Mr. HOLGATE.—Who was it who first spoke about it being crooked?

Mr. D. LAJEUNESSE.—All the bridgemen from all over the bridge. When I saw every man stop I asked my brother, who was there talking French and who was with me, 'What is the matter?' He says, 'Look on that chord.' I said, 'It is dangerous.' He said, 'Oh, no, it is strong enough to hold me.' We went to work, and the next day we fell down. When I saw some one go down there—the president of the Union——

Mr. HOLGATE.—Who is he?

Mr. D. LAJEUNESSE.—Mr. Haley, and Mr. Cook was the secretary. I was waiting on him outside on Wednesday night, the day before the accident, to give him my books for my Union. I was waiting about half an hour, and some one said to me, 'Just look at that chord.' I saw Mr. Cook and Mr. Haley go down there, and after they had been there half an hour I saw them going away. I do not know what they did there.

Mr. HOLGATE.—It was just Cook and Haley?

Mr. D. LAJEUNESSE.—Cook, Haley, and some other fellows. I do not know their names. There were three or four.

Mr. HOLGATE.—When you observed that bulge, in the chord in panel 9, did you notice anything wrong with the lacing angles?

Mr. D. LAJEUNESSE.—No, I did not see anything. I did not look at that, I just looked at the chord that was crooked. I did not see the angles there.

Mr. HOLGATE.—You do not think it was crooked enough to affect the angles?

Prof. GALBRAITH.—You did not see that after Tuesday night?

Mr. D. LAJEUNESSE.—I did not see that but that day.

Prof. GALBRAITH.—You looked on Wednesday?

Mr. D. LAJEUNESSE.—Yes.

Prof. GALBRAITH.—You looked on Thursday morning?

Mr. D. LAJEUNESSE.—Yes, I looked every morning going out.

Prof. GALBRAITH.—You saw it three days?

Mr. D. LAJEUNESSE.—Yes, three days, all the time in the same place. I think they were moving; I do not know.

Mr. HOLGATE.—Could you notice any change that had taken place in it, did it look any worse?

Mr. D. LAJEUNESSE.—No, I did not look long enough; I just saw it was more crooked; it was the same place all the time. Somebody said that Foreman Worley said, 'Oh, never mind, we put it like that.'

Mr. HOLGATE.—What do you think Mr. Worley meant by that?

Mr. D. LAJEUNESSE.—I thought that piece was the same way as it had been there.

Mr. HOLGATE.—As it was put in?

Mr. D. LAJEUNESSE.—Yes. I do not know, when I started to work it was over there in front.

Mr. HOLGATE.—Do you recollect your attention being called to any other matters like that on the bridge?

Mr. D. LAJEUNESSE.—No, I did not see anything. I worked every place on the bridge, on top, on the centre post, from the top down to the bottom, I did not see anything.

Mr. HOLGATE.—Did you often go on the bottom chord on the anchor arm?

Mr. D. LAJEUNESSE.—Yes, going up and going down.

Mr. HOLGATE.—You spoke a little while ago about working with Beauvais at some place on the lower chord on the Montreal side, in the anchor arm?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Was that at the post between panel 9 and panel 10?

Mr. D. LAJEUNESSE.—Right there (indicating). There on the cover plate, the two cover plates. We put some rivet plates on the side.

Mr. HOLGATE.—On the side of the chord?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Was that at the splice between panel 9 and panel 10?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—On each side of the post?

Mr. D. LAJEUNESSE.—Yes. I was riveting on the box brace going from the Montreal side to the Quebec side.

Mr. HOLGATE.—What day was this that you were working there?

Mr. D. LAJEUNESSE.—I think it was a week before, I do not remember.

Mr. HOLGATE.—Did they finish the work they were at?

Mr. D. LAJEUNESSE.—Over there, no. They were working there that day?

Mr. HOLGATE.—You left the gang and worked on something else?

Mr. D. LAJEUNESSE.—Yes, they put some Indian fellows.

Mr. HOLGATE.—And the gang with Beauvais stayed there, did they?

Mr. D. LAJEUNESSE.—Stayed there, I think they were there on that day. I saw 400 rivets put inside those four plates.

Mr. HOLGATE.—When you left they had 400 rivets to put in?

Mr. D. LAJEUNESSE.—I think they had 200 or 300 rivets, 300, 400, you see the four plates in the bottom chord they had to rivet inside. I think they had about 100 rivets to finish at that place?

Prof. KERRY.—When the bridge fell?

Mr. D. LAJEUNESSE.—Yes. When I left them he was working over there, he had big work to do. I saw him go up there when the bridge fell.

Mr. HOLGATE.—When you were working there with Beauvais did anything unusual happen?

Mr. D. LAJEUNESSE.—No, we did not see anything there.

Mr. HOLGATE.—Was there anything that appeared to you to be out of line?

Mr. D. LAJEUNESSE.—No.

Mr. HOLGATE.—On that chord?

Mr. D. LAJEUNESSE.—I did not see anything.

Mr. HOLGATE.—Or any place in that neighbourhood?

Mr. D. LAJEUNESSE.—No, it was all good over there.

Mr. HOLGATE.—Now, before you started riveting was that joint bolted up?

Mr. D. LAJEUNESSE.—Yes, bolted up.

Mr. HOLGATE.—Fully bolted?

Mr. D. L. LAJEUNESSE.—Yes, fully bolted up.

Mr. HOLGATE.—Was every hole filled?

Mr. D. LAJEUNESSE.—Yes, we did not pass any reamer. Sometimes they have to pass a reamer.

Mr. HOLGATE.—Were all the bolts the same size?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—What size?

Mr. D. LAJEUNESSE.—$\frac{7}{8}$.

Mr. HOLGATE.—All the holes were filled with $\frac{7}{8}$ bolts?

Mr. D. LAJEUNESSE.—Yes, I did not look very well.

Prof. GALBRAITH.—I would like to know something about the other one on the Montreal side, opposite the joint between 9 and 10? It is on the 9th chord, that splice, the other end of the 9th chord.

Mr. HOLGATE.—Did you ever work at the splice in the 9th chord near the panel point marked 9?

Mr. D. LAJEUNESSE.—No, I did not work there at all. I passed in on that side. The only thing I see, they had those runners there sent out.

Mr. HOLGATE.—I understand you passed along there?

Mr. LAJEUNESSE.—Yes, that is all I see.

Mr. HOLGATE.—Can you recollect anything about the bolting up of them?

Mr. D. LAJEUNESSE.—They were riveting there.

Mr. HOLGATE.—Riveting there?

Mr. D. LAJEUNESSE.—When I started working on the bridge they were working at that place.

Mr. HOLGATE.—Can you remember if that joint near panel point 9 was riveted up when the bridge fell?

Mr. D. LAJEUNESSE.—The riveting was all finished there.

Prof. GALBRAITH.—All finished?

Mr. D. LAJEUNESSE.—All finished.

Prof. GALBRAITH.—On both sides of the bridge.

Mr. D. LAJEUNESSE.—On both sides, the two sides, there is only on that side there, the two joints there; the Quebec side was finished.

Prof. GALBRAITH.—You refer now to panel point No. 10?

Mr. D. LAJEUNESSE.—Yes.

Prof. GALBRAITH.—The panel point, the No. 9 splice, was riveted; was it completely riveted on both sides?

Mr. D. LAJEUNESSE.—Yes, completely riveted; I was moving the scaffolding myself there. The other gang was working around here—Paul La Hache.

Mr. HOLGATE (to Eugène Lajeunesse).—Are you following what your brother says?

Mr. EUGENE LAJEUNESSE.—Yes, Alexander Beauvais finished that other side.

Mr. HOLGATE.—So far as what his brother says, he is correct as he understands it?

Mr. EUGENE LAJEUNESSE.—No, he does not know all.

Mr. HOLGATE.—Is there anything within his knowledge in his brother's statement that he can corroborate? If there is he might speak of it.

Mr. EUGENE LAJEUNESSE (speaking in French).—About the men working there was a gang of men working on the other side, but my brother probably does not know, because he was not working there.

Mr. HOLGATE.—So far as he knows he is clear upon that point 9, and that Beauvais had finished up there?

Prof. GALBRAITH.—Between 9 and 10.

Mr. Eugene LAJEUNESSE.—He was putting the finish; that riveting gang stopped the work three days before.

Prof. GALBRAITH.—He has said already there is nothing wrong with that joint 9 and 10.

Mr. HOLGATE.—Yes, he says that is all straight.

Mr. D. LAJEUNESSE.—On the Quebec side?

Mr. HOLGATE.—Yes?

Mr. D. LAJEUNESSE.—Myself and my brother and another one were moving that scaffold.

Mr. HOLGATE.—You never saw anything wrong on the Montreal side?

Mr. D. LAJEUNESSE.—No, I never saw anything wrong there.

Prof. GALBRAITH.—He has already said that; on both sides; between 8 and 9 he never saw anything.

Mr. HOLGATE.—He said that had been finished and he saw nothing wrong.

Prof. GALBRAITH.—On both sides?

Mr. D. LAJEUNESSE.—On both sides; once I was riveting and another time not.

Prof. GALBRAITH.—That means all four joints, the two 9 and 10 and the two 8 and 9?

Mr. HOLGATE.—Yes, and on the Quebec side; the joint between 9 and 10, when the accident happened, must have had at least another 100 rivets to go in.

Prof. GALBRAITH.—Yes.

Mr. HOLGATE.—Are there any other joints in the lower chord——?

Mr. D. LAJEUNESSE.—No, I did not see anything.

Mr. HOLGATE.—Were they all riveted up?

Mr. D. LAJEUNESSE.—No, some riveters were on there; I do not know which plate.

Mr. HOLGATE.—There was some riveting yet to be done on the lower chord of the anchor arm, but you do not know which one?

Mr. D. LAJEUNESSE.—I do not know which place.

Mr. HOLGATE.—You spoke about something on the cover plate.

Mr. D. LAJEUNESSE.—Yes, on the Quebec side; I saw Mr. Yenser going down there at the time when someone said the plate was crooked. I was bolting the screw bolts and he said: 'You know that chord; when you have finished inside you put some bolts in it, pass the reamer and put in some bolts.

Mr. HOLGATE.—That is where chord 10 joined the centre post on the Montreal side?

Mr. D. LAJEUNESSE.—The Montreal side.

Mr. HOLGATE.—What day was that?

Mr. D. LAJEUNESSE.—That was on the same day, on Tuesday, I think.

Mr. HOLGATE.—And how many bolts did you put in?

Mr. D. LAJEUNESSE.—I did not put any in. He sent me up, he told me to go up and help some fellow on top.

Mr. HOLGATE.—He instructed you to put bolts there?

Mr. D. LAJEUNESSE.—Yes.

Mr. HOLGATE.—Did somebody else put those bolts there?

Mr. D. LAJEUNESSE.—No, nobody, I did not see anybody.

Mr. HOLGATE.—Did you see the place itself?

Mr. D. LAJEUNESSE.—Yes, I saw the place.

Mr. HOLGATE.—How many bolts had to go in there?

Mr. D. LAJEUNESSE.—About 50 bolts, 40 or 50.

Mr. HOLGATE.—If 50 bolts had been put in there would that have filled up everything?

Mr. D. LAJEUNESSE.—Yes, we have about 60 bolts, 70 bolts, we always screw them up and like to put 50 more.

Mr. HOLGATE.—Is that where the chord joined the shoe?

Mr. D. LAJEUNESSE.—Yes.

Prof. GALBRAITH.—The stub chord?

Mr. D. LAJEUNESSE.—Yes, where the chord crosses to the centre post. It is about two feet away from the centre post.

Mr. HOLGATE.—Two feet on the anchor arm side from the centre post?

Prof. GALBRAITH.—That was the spliced centre chord of the stub chord.

Mr. D. LAJEUNESSE.—Yes, on the side chord, he told me to put some bolts there.

Mr. HOLGATE.—The 10th chord?

Prof. PERRY.—He said that bolts were to be put in in the connection between the stub chord and chord No. 10 on the anchor arm?

Mr. HOLGATE.—Did you see that place again?

Mr. D. LAJEUNESSE.—For these bolts there?

Mr. HOLGATE.—Yes.

Mr. D. LAJEUNESSE.—No, I did not go down after that, he sent me up to move that scaffold, our riveters' gang, I did not see it, I did not go down.

Mr. HOLGATE.—So you cannot say if the bolts were put in ?

Mr. D. LAJEUNESSE.—No, I did not see it; only me and my brother do that work.

Mr. HOLGATE.—You said it was Yenser who went down there ?

Mr. LAJEUNESSE.—Yes, and the other inspector, Birks. He went down and looked at that place and after that he called me and said : You put some bolts in when you finish that side.

Prof. GALBRAITH.—What day was that?

Mr. D. LAJEUNESSE.—On Tuesday.

Mr. HOLGATE.—Did you notice any of the plates in any part of the bridge cracked?

Mr. D. LAJEUNESSE.—I never saw any place, I worked all around the bridge and did not see any crack in that bridge.

Mr. HOLGATE.—Were you ever up here at this part of the bridge at the centre post where these plates are (indicating)?

Mr. D. LAJEUNESSE.—Yes, they have one plate going like that and another one going like that (the witness indicated plates going in various directions).

Mr. HOLGATE.—Were you there more than once ?

Mr. D. LAJEUNESSE.—Oh, yes, I worked in there about 15 days on that place.

Mr. HOLGATE.—And during those 15 days did you notice anything wrong?

Mr. D. LAJEUNESSE.—I never saw anything wrong, that plate was put like that.

Mr. HOLGATE.—You mean that the plate was bent on purpose ?

Mr. D. LAJEUNESSE.—Yes, they made it like that, it never cracked that way.

Mr. HOLGATE.—It was crimped?

Mr. D. LAJEUNESSE.—Yes, crimped, I never saw a crack there.

Mr. HOLGATE.—You are pretty sure there was no crack there ?

Mr. D. LAJEUNESSE.—Yes, I am pretty sure, me and my brother worked 15 days there and I did not see anything cracked.

Mr. HOLGATE.—Did you hear anything about a cracked plate there while working on the bridge ?

Mr. D. LAJEUNESSE.—No, I never saw any cracked plate there.

Mr. HOLGATE.—Did you ever hear any one speak of that ?

Mr. D. LAJEUNESSE.—No, nobody told me, this is the first time anybody tells me.

Prof. GALBRAITH.—Did you hear of anything wrong with any other joints in the chords besides those you have been speaking about ?

Mr. D. LAJEUNESSE.—I did not see anything.

Prof. GALBRAITH.—Did you hear ?

Mr. D. LAJEUNESSE.—No, I did not see anything dangerous in that bridge about chord 9.

Mr. HOLGATE.—Did anybody speak to you about anything else in that bridge that was wrong ?

Mr. D. LAJEUNESSE.—No, nobody ; until on that morning, when somebody said about that chord. I worked and nobody told me there is anything dangerous.

The witness retired.

The Commission held a session in the Lévis Hospital.

ALEXANDER BEAUVAIS sworn.

Mr. HOLGATE.—You were an employee of the Phœnix Bridge Company?

Mr. BEAUVAIS.—Since last May up to the time of the accident.

Mr. HOLGATE.—Since May, 1907?

Mr. BEAUVAIS.—1907.

Mr. HOLGATE.—And you worked at the Quebec bridge?

Mr. BEAUVAIS.—The Quebec bridge, south side.

Mr. HOLGATE.—On the south side?

Mr. BEAUVAIS.—Yes, sir.

Mr. HOLGATE.—Continuously?

Mr. BEAUVAIS.—As the weather permitted.

Mr. HOLGATE.—What was the nature of the work that you were busy at?

Mr. BEAUVAIS.—I was on riveting most of the time.

Mr. HOLGATE.—Was your work entirely confined to the anchor arm, or where?

Mr. BEAUVAIS.—I was working on the anchor arm, I never worked outside the pier.

Mr. HOLGATE.—You never worked outside the pier?

Mr. BEAUVAIS.—All this season.

Mr. HOLGATE.—By that do I understand that you worked last season?

Mr. BEAUVAIS.—I worked three seasons.

Mr. HOLGATE.—But this year you worked from May?

Mr. BEAUVAIS.—From May up to the time of the accident.

Mr. HOLGATE.—Previous to working on the Quebec bridge, did you do work on other bridge construction?

Mr. BEAUVAIS.—Yes, I worked for Dominion Bridge Company and the Canadian Bridge Company, four or five different jobs.

Mr. HOLGATE.—For some years?

Mr. BEAUVAIS.—Since six years, I guess this is my sixth year.

Mr. HOLGATE.—Who was your foreman this season on the work?

Mr. BEAUVAIS.—C. E. Meredith, rivet boss we called him.

Mr. HOLGATE.—Then your own position under Mr. Meredith is what?

Mr. BEAUVAIS.—I was the head of a four gang, running a gang of four men.

Mr. HOLGATE.—A gang of four men riveting?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—And that work was confined entirely to the anchor arm?

Mr. BEAUVAIS.—Yes, sir, the anchor arm.

Mr. HOLGATE.—Were there other riveting gangs on the anchor arm?

Mr. BEAUVAIS.—There was one that just moved from there about two or three days before the accident. The best I can remember, there was no gang besides our gang working on the anchor arm.

Mr. HOLGATE.—What was the condition of the riveting work on the anchor arm when you began work this season in May? How far had the riveting work proceeded?

Mr. BEAUVAIS.—It was very little riveted, it was only on the towers and perhaps one-fifth of it was riveted, but the towers. I do not think there was any other place riveted to my knowledge, because last summer or the summer before last we only had a gang or two, sometimes only a single gang, and this summer sometimes seven or eight.

Mr. HOLGATE.—On the anchor arm?

Mr. BEAUVAIS.—Well, I think on the anchor arm at first we had four.

Mr. HOLGATE.—This season?

Mr. BEAUVAIS.—Yes, this season.

Mr. HOLGATE.—Was there some riveting work going on on the anchor arm the whole of this season, was there always riveting on the anchor arm this season?

Mr. BEAUVAIS.—Always riveting, yes.

Mr. HOLGATE.—At the time of the accident, what, as far as your knowledge goes, was the general condition of riveting, how far had it proceeded?

Mr. BEAUVAIS.—Oh, the riveting was almost completed up to the working gang, almost up to the working, almost completed, the riveting was.

Mr. HOLGATE.—Almost completed up to the working gang that was working on the cantilever arm?

Mr. BEAUVAIS.—Yes, there was riveting on the cantilever arm, too.

Mr. HOLGATE.—That is they were following up as fast as they could with the riveting?

Mr. BEAUVAIS.—They were almost up to the erectors, the riveters were.

Mr. HOLGATE.—What was the condition then of the posts, as far as riveting is concerned on the anchor arm?

Mr. BEAUVAIS.—The posts?

Mr. HOLGATE.—At the time of the accident?

Mr. BEAUVAIS.—I saw nothing wrong about the posts. To my knowledge I saw nothing out of the way.

Mr. HOLGATE.—Then can you say as to the condition of riveting that existed at the time of the accident in the lower chords?

Mr. BEAUVAIS.—The lower chords, they were bent.

Mr. HOLGATE.—But with regard to riveting, can you remember, starting from the anchor pier, and going along the bottom chord on the Quebec side of the bridge?

Mr. BEAUVAIS.—I only worked two joints on that bottom chord. There is the only two joints I worked on the Quebec and Montreal side, the east and west side (indicating on Exhibit No. 26).

Mr. HOLGATE.—On the east and west side, that is at the first post from the centre post?

Mr. BEAUVAIS.—The first post from the shoe.

Mr. HOLGATE.—On the anchor arm?

Mr. BEAUVAIS.—On the anchor arm.

Mr. HOLGATE.—That is the joint between panels 9 and 10?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—You worked on that joint, on both sides of it?

Mr. BEAUVAIS.—The Quebec side, and I was on the Montreal side at the time it fell.

Mr. HOLGATE.—Had you finished your work on the Quebec side?

Mr. BEAUVAIS.—They finished it, and moved to the Montreal side.

Mr. HOLGATE.—Was the joint on the Quebec side when you finished it completely riveted up?

Mr. BEAUVAIS.—Every hole excepting one, I remember which was a blind hole. One plate was not punched.

Mr. HOLGATE.—With the exception of that, though, the joint was complete?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—That is the top plates, bottom plates, and side plates?

Mr. BEAUVAIS.—Everything was on, every hole, bottom plates, top plates, every hole, everything was on.

Mr. HOLGATE.—When you started work on that splice, on the Quebec side, how did you find it?

Mr. BEAUVAIS.—Well, the holes were all right, they were good holes, and then—that is an awful big joint, we were there for two weeks, we could notice a bulging, coming together. There are four ribs; the centre ribs were coming together, not much, but one could notice it.

Mr. HOLGATE.—They were getting nearer together, the ribs were?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—At the end of each chord?

Mr. BEAUVAIS.—Right here at the splice of this chord, this 9 and 10 chord.

Prof. GALBRAITH.—Which side of the post?

Mr. BEAUVAIS.—On the inside.

Mr. HOLGATE.—It is in panel 10. Well, if the ribs were coming closer together, that would cause the plate to bulge?

Mr. BEAUVAIS.—You had to get the bottom plate off to work in there, so as to work in there. Of course we managed to get the plate back on again.

Mr. HOLGATE.—In the same holes?

Mr. BEAUVAIS.—Yes, in the same holes. The holes were not very bad, because it did not close much, we got the holes again.

Mr. HOLGATE.—Did you manage to put it back again with drift pins?

Mr. BEAUVAIS.—Yes, just drift pins.

Mr. HOLGATE.—But there was a tendency of the ribs——

Mr. BEAUVAIS.—Yes, but very little. Of course we could notice because we had heard before of ribs bending, because there was another gang driving the same way as we were, driving the same kind of joints, bottom chords?

Mr. HOLGATE.—Where were they working?

Mr. BEAUVAIS.—Out on the cantilever arm, about the fifth or sixth panel.

Mr. HOLGATE.—Now, to come back to that joint on the Quebec side, when you went to start your riveting work was that joint pretty well bolted up?

Mr. BEAUVAIS.—Well, it was all jointed up except that they were not very tight, and of course we had to tighten them bolts up again, that is on the Quebec side.

Mr. HOLGATE.—Was there a large quantity of bolts, a large proportion?

Mr. BEAUVAIS.—There were very few holes vacant on the Quebec side.

Mr. HOLGATE.—Did it differ materially from other joints you had noticed, before you went to work on it; was it bolted up as well as any other joint?

Mr. BEAUVAIS.—Not at all; it was pretty well bolted up because only a few holes were vacant.

Mr. HOLGATE.—Generally speaking, when you went on a joint did you find it in that condition, pretty well bolted up?

Mr. BEAUVAIS.—I found it sometimes very different from this. On the Montreal side it was very bad, very few holes bolted.

Prof. GALBRAITH.—On the Montreal side, the very same joint?

Mr. BEAUVAIS.—The Montreal side, the same joint.

Mr. HOLGATE.—When you took hold of this joint on the Quebec side what first did you do? When you took your men to a joint that was bolted up and started to rivet it, you might describe to us the process, which plate you put on first, what bolts you loosened first and what ribs you riveted first?

Mr. BEAUVAIS.—The first thing there was a scaffold hung; that is we got a scaffold fixed so as to be safe; then we lowered the bottom cover plate down on the scaffold. Then we had two angles sent down, these were the inspector's orders, to place them where we got the bottom cover plates, these angles to act instead of the plates, two small angles. Then our first work was to tighten the bolts up. There were very few vacant holes. There were 280 holes altogether on the inside ribs; and then the inspector told me I should not take out more than 5 or 6 bolts at a time, and then drive these holes, and then take 5 or 6 more bolts out. The first thing we drove was the two inside ribs. The inside rib holes were $\frac{7}{8}$-inch holes and the outside 1-inch holes.

Prof. GALBRAITH.—How many holes in one rib?

Mr. BEAUVAIS.—In each rib 140, on each rib, 140 holes. It was about this second day, and another man who is living yet saw the ribs bending with me.

Mr. HOLGATE.—Then you riveted up the bottom chord?

Mr. BEAUVAIS.—No, I had to rivet the top plate first so I could get at the bottom easier, and after we got the bottom plate on we put on the top.

Mr. HOLGATE.—And the riveting of the bottom plate was the last thing?

Mr. BEAUVAIS.—No, because there was these bottom laterals, they were the last plates we had to drive.

Mr. HOLGATE.—The bottom lateral bracing?

Mr. BEAUVAIS.—Yes.

Prof. GALBRAITH.—First of all, I understand you tighten up the bolts, have them all tight and filled before you begin any riveting; then you proceed to take out the bolts in the top cover plate and rivet them first; after that you take out the bolts in the two inside ribs, working from the bottom, and rivet them; then you rivet the two outside ribs, then you put on the bottom cover plate and rivet it. Is that the order of riveting?

Mr. BEAUVAIS.—I did not say I drove the cover plate first, the inside ribs first.

Prof. GALBRAITH.—You rivet them first?

Mr. BEAUVAIS.—Two of them; then the outside ribs, then the top cover plate. Of course I had to leave that to the last.

Prof. GALBRAITH.—And then the bottom cover plate?

Mr. BEAUVAIS.—Yes, and the last is the laterals.

Prof. GALBRAITH.—After the top cover plate the bottom cover plate?

Mr. BEAUVAIS.—Yes.

Prof. GALBRAITH.—And then the laterals going across to the other side of the bridge?

Mr. BEAUVAIS.—Yes, diagonally like, wind bracing I think they call it.

Prof. GALBRAITH.—Or laterals, anyway?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—Then when the laterals were all riveted up that joint was complete?

Mr. BEAUVAIS.—Yes. The inspector passed over, and he had two or three to cut out, we drove them back again and moved to the Montreal side.

Mr. HOLGATE.—Who was the inspector?

Mr. BEAUVAIS.—Mr. Kinloch.

Mr. HOLGATE.—I suppose he visited you pretty often, did he? He saw you pretty often at work?

Mr. BEAUVAIS.—He was always on the job, yes, sir. I very often seen him on the job, most of the time.

Mr. HOLGATE.—Now, I think we can pass over to the joint on the Montreal side. That is where you moved to after you left the joint on the Quebec side?

Mr. BEAUVAIS.—Yes, sir.

Mr. HOLGATE.—In what condition did you find that joint when you went to it, as to bolts? Was it bolted up the same as the one on the Quebec side?

Mr. BEAUVAIS.—No, it was very bad, because I am sure there were not more than 22 or 25 ⅞ bolts in there. These two inside ribs, they were all ⅞ inside, most of them.

Prof. GALBRAITH.—In the two inside?

Mr. BEAUVAIS.—In the two inside. That makes 280, 140 in each.

Prof. GALBRAITH.—Mostly ⅞.

Mr. BEAUVAIS.—Mostly, there was not more than 22 to 25, that is all the ⅞ bolts in that.

Prof. GALBRAITH.—Did you find the bolts tight?

Mr. BEAUVAIS.—No, it is very seldom you find a bolt tight by the erectors putting them in, they just screw them in and leave them.

Mr. HOLGATE.—Was there any reason for putting in the ⅞?

Mr. BEAUVAIS.—Nothing. Sometimes at first we had to pass a reamer for the reason that they were bad holes, but as the work went on the holes were getting good all the time, springing in like. I suppose it was that reason, I could not say, it might have been bad holes.

Mr. HOLGATE.—When you found that condition, what did you do, put in more bolts?

Mr. BEAUVAIS.—I had to go up and there were bolt boys, we call them, five or six, on the shore, fixing bolts, oiling them. I told Benny and he ordered the boy to fetch me a big box of ⅞ bolts, and it was impossible to drive the ⅞ because they would not drive tight enough.

Mr. HOLGATE.—Was there any trouble in getting the ⅞ bolts in?

Mr. BEAUVAIS.—Not at all, because there were good holes and room enough.

Mr. HOLGATE.—Room enough?

Mr. BEAUVAIS.—Room enough to work, they were good holes.

Mr. HOLGATE.—So it might have been possible to change the ⅞ bolts for ⅞ bolts before you got to the joint?

Mr. BEAUVAIS.—Yes, I do not know how long before they could have been changed. At that very same point I saw three extra plates that were mended. I worked on the same joint and I saw three extra plates that were mended. It was riveted and there were not more than five or six bolts in it. There were vacant holes. Two of these plates had from 35 to 40 bad holes, and one of them had only a single row of holes stripped.

Prof. GALBRAITH.—Were these left near the joint?

Mr. BEAUVAIS.—On the side of the joint; between the joint and the post.

Mr. HOLGATE.—Do you remember what day it was you went to start work on that joint?

Mr. BEAUVAIS.—I could not remember very well.

Mr. HOLGATE.—Was it that week?

Mr. BEAUVAIS.—It must have been four days before the accident. There was one Sunday between. I would not swear what day I got there.

Mr. HOLGATE.—What progress had you made with the riveting work?

Mr. BEAUVAIS.—This time I riveted the bottom lateral first before I went on this joint.

Mr. HOLGATE.—Had you any particular reason for doing that?

Mr. BEAUVAIS.—For driving the lateral first?

Mr. HOLGATE.—Yes.

Mr. BEAUVAIS.—Because there were only two of these machines that worked inside the chord on the job and they were both busy at the time. There was another gang working on the anchor arm. Of course, I had to do something else until the machine got back.

Mr. HOLGATE.—You riveted up the bottom lateral. What was the next step?

Mr. BEAUVAIS.—The next step was to go down the scaffold and put more lines on it for safety, and unload the plates on the scaffold. The next was to change these ⅞ bolts.

Mr. HOLGATE.—When you lowered that plate on the scaffold, did you put on your angles?

Mr. BEAUVAIS.—I certainly did, because the inspector is always watching us for that.

Prof. GALBRAITH.—I want to make quite sure which diagonal he means.

Mr. BEAUVAIS.—It is the bottom lateral which goes from panel point No. 10 to the shoe.

Mr. HOLGATE.—You lowered your plate and put on the angles?

Mr. BEAUVAIS.—Put on the angles. The inspector is watching us pretty sharp. Then I found these ⅞ bolts in there and the vacant holes. I had to go up and tell Mr. Yenser about that and he ordered them to send a boy to bring me down ⅞ bolts instead of the ⅞ bolts.

Prof. GALBRAITH.—Which side is he speaking of now?

Mr. BEAUVAIS.—The Montreal side.

Mr. HOLGATE.—And you put in as many ⅞ bolts as you could?

Mr. BEAUVAIS.—Yes, as many as necessary to have the plate come up tight. We had about three-quarters or more bolts in there and left the quarter of the holes vacant and then started to drive the rivets. There were some bad holes—a very few—that we had to ream before we could get the rivets into them.

Prof. GALBRAITH.—Were these plates riveted in the shop on one side of the joint or had you to rivet them on both sides of the joint?

Mr. BEAUVAIS.—We had to rivet them on both sides of the joint. We had to fill them.

Mr. HOLGATE.—Then you continued your riveting?

Mr. BEAUVAIS.—In the same way as on the Quebec side—the inside rivets first.

Mr. HOLGATE.—Had you completed the riveting of the inside rivets?

Mr. BEAUVAIS.—Only 13 or 14 holes were driven on the two inside ribs.

Mr. HOLGATE.—How much had you done on the outside work?

Mr. BEAUVAIS.—Nothing at all, because I was supposed to get through with the inside before touching the outside at all.

Mr. HOLGATE.—But the outside ribs were all pretty securely bolted up at that time?

Mr. BEAUVAIS.—They were bolted up good—inch bolts and very few seven-eighths.

Mr. HOLGATE.—And the bottom plate, of course, was off?

Mr. BEAUVAIS.—It was off and the top plate—the inspector came down the very morning the accident took place and looked at the top plate. It was off three-quarters of an inch or an inch. It was kicking up like because it was not bolted. We had to put drift pins in every hole; they were not bolted, only on the end there were eight bolts where you could reach with the hand.

Prof. GALBRAITH.—But the top plate was not lying close to the ribs?

Mr. BEAUVAIS.—It was not lying right down to the chord. It was off half an inch, or three-quarters or perhaps more.

Prof. GALBRAITH.—At which end?

Mr. BEAUVAIS.—At the outer end, towards the anchor pier.

Mr. HOLGATE.—Did you have any difficulty in putting on the bottom angles? Did these holes come even?

Mr. BEAUVAIS.—It came right because we put it right down before starting in. But this powerful gun jarred the chords. You could feel the jar of the chords. There is where I found two rivets broken out right near the splice. They broke out about half an hour before the accident took place.

Mr. HOLGATE.—It broke the rivets you had driven?

Mr. BEAUVAIS.—These were two rivets in the same place.

Mr. HOLGATE.—Were both rivets broken in the same holes?

Mr. BEAUVAIS.—Five or six inches apart.

Mr. HOLGATE.—They were in separate holes?

Mr. BEAUVAIS.—Yes, next to each other.

Mr. HOLGATE.—Were they inch rivets?

Mr. BEAUVAIS.—No, seven-eighth rivets.

Prof. GALBRAITH.—How long after they were put in did you find them broken?

Mr. BEAUVAIS.—I drove them the same hour. It was not I who found them broken off. It was my partner who found them first.

Prof. GALBRAITH.—What is his name?

Mr. BEAUVAIS.—John Norton.

Mr. HOLGATE.—Did he survive?

Mr. BEAUVAIS.—No, he is gone.

Prof. KERRY.—How were they broken off?

Mr. BEAUVAIS.—He pulled it out and showed it to me and said, 'Look here.' He said, 'I found it off a quarter of an inch.' I asked, 'How did you take it out,' and he said, 'it was off almost a quarter of an inch and I pulled it out.' It was broken almost in the centre.

Mr. HOLGATE.—Can you account for these two particular rivets being broken? There were other rivets that may have been strained in the same way; why should not they have broken?

Mr. BEAUVAIS.—Of course, I did not test them. If I had I would know just exectly what was broken and what was not, but while I was driving two or three other rivets, after that I found the first one broken off. He said, 'There is another one broken,' and I tested it with a drift pin and it was broken off straight. You could turn the one end and the other end would be still. It was impossible to pull it out because it was plugged in there. There were two rivets broken. I called Mr. Meredith, the rivet boss, and also to see that the ribs were bending in. He looked down there and told me that it was not any worse than the others. He did not think it serious.

Prof. GALBRAITH.—The ribs were bending in?

Mr. BEAUVAIS.—Yes.

Prof. KERRY.—At what time did Meredith come down?

Mr. BEAUVAIS.—He was not more than seven or ten minutes gone up before the accident.

Mr. HOLGATE.—What called your attention to the ribs bent in? You mean by that that they were coming closely together at the joint?

Mr. BEAUVAIS.—They were going out to the Montreal side. They were both going the same way—these two ribs.

Mr. HOLGATE.—Which ribs?

Mr. BEAUVAIS.—The inside ribs.

Mr. HOLGATE.—Both moving towards Montreal?

Mr. BEAUVAIS.—Yes, the Montreal side. At the same time he was down there I showed him about that extra plate which was mended and there were very bad holes and you could hardly get the bolts out. They must have been put in after the other holes were punched.

Mr. HOLGATE.—The extra joint plate?

Mr. BEAUVAIS.—The extra joint plate, between the splice and the post. That can be seen yet because it is inside the pier.

Prof. KERRY.—That extra plate was on the inside of the inside ribs?

Mr. BEAUVAIS.—There was one on the inside ribs and one on the outside ribs. That was a long plate in the same direction as the bottom cover plate. There was only one row of bolts in the one on the inside, and there were 35 or 40 bolts on the one on the outside, and there were just enough bolts to hold the plates on.

Mr. HOLGATE.—Now you are referring to what you said before of the extra plate where that chord was mended?

Mr. BEAUVAIS.—Yes, sir.

Prof. KERRY.—You can see that on the ground because that joint is perfect.

Mr. BEAUVAIS.—Yes, you can find that yet. I did not see anything removed but it was extra altogether. This chord in No. 9 panel on the Montreal side is bent very close together—right in the centre—right between the two posts.

Prof. GALBRAITH.—The centre ribs come together?

Mr. BEAUVAIS.—Yes. That is on the Montreal side, and I believe Mr. John Williams saw that. They go up or down beyond that to the traveller, and you cannot help seeing it.

Prof. GALBRAITH.—That is about half way between the panel points?

Mr. BEAUVAIS.—Yes, on panel No. 9, Montreal side.

Prof. KERRY.—How much was it bent?

Mr. BEAUVAIS.—I did not measure, but I am sure an inch or an inch and a quarter.

Prof. GALBRAITH.—Bent in?

Mr. BEAUVAIS.—Yes.

Prof. GALBRAITH.—Towards each other?

Mr. BEAUVAIS.—Yes.

Prof. GALBRAITH.—Each an inch and a quarter?

Mr. BEAUVAIS.—A space about that.

Mr. HOLGATE.—Would not that have shown on the lacing?

Mr. BEAUVAIS.—I did not investigate that enough to say about the lacing. I know that a day or two before the accident happened Mr. Birks and Mr. Yenser were there examining it on the Montreal side. They were there for an hour or perhaps more.

Prof. KERRY.—How long was the bend?

Mr. BEAUVAIS.—It was almost the whole length.

Mr. HOLGATE.—Was there anything noticeable on the outside ribs?

Mr. BEAUVAIS.—On the outside ribs you could not see as well if it had bent because it is wider than the inside ribs, but in these inside ribs it was not more than two inches apart. You could see it easily where it was close together.

Mr. HOLGATE.—Were they close together ?

Mr. BEAUVAIS.—Almost that close, more than an inch.

Prof. GALBRAITH.—They were not more than two inches apart ?

Mr. BEAUVAIS.—They cannot be more than two inches apart.

Prof. GALBRAITH.—Did you notice between them and the outer ribs that the space was wider than it was originally ?

Mr. BEAUVAIS.—I could not very well notice it unless you measured it because the space is too wide ; it is something like 15½ inches. An inch or three-quarters of an inch would not show much out unless you measured it.

Mr. HOLGATE.—Did you have any conversation with Mr. Birks or Mr. Yenser when they were down there ?

Mr. BEAUVAIS.—No, nothing at all; only, Mr. Yenser told me not to take out more than five or six bolts at a time. I heard him say that once.

Mr. HOLGATE.—That was on what day ?

Mr. BEAUVAIS.—It was about a day or two before the accident happened.

Prof. KERRY.—Did you look at the joint at the other end of the chord ?

Mr. BEAUVAIS.—I did not. I could see it there. There were bolts in there.

Prof. KERRY.—It was not riveted ?

Mr. BEAUVAIS.—No.

Mr. HOLGATE.—The joint between 8 and 9 was riveted ? The joint between 9 and 10 is where he was working and now then he is referring to the joint at chord 10 with the stub chord down near the shoe. That was not riveted ?

Mr. BEAUVAIS.—That was bolted.

Mr. HOLGATE.—Was it fully bolted?

Mr. BEAUVAIS.—I could not say, because I did not look sharp enough at it.

Prof. GALBRAITH.—Which side?

Mr. BEAUVAIS.—On the Montreal side.

Mr. HOLGATE.—Having got to the point where you saw these two or more rivets broken, do you recollect anything between that and the collapse of the bridge?

Mr. BEAUVAIS.—I guess not. I was driving rivets, and I was about to shoot another rivet when the crash came down.

Mr. HOLGATE.—When it came have you any recollection of how this point which you were working at acted? What took place in that joint?

Mr. BEAUVAIS.—When it fell?

Mr. HOLGATE.—Did it fall?

Mr. BEAUVAIS.—I did not see how it fell.

Mr. HOLGATE.—You were right inside?

Mr. BEAUVAIS.—Right inside. I was right inside the chord, and I had to come out underneath because I had to pry the plate off. As soon as I felt it break I made a grab for the plate. I had my arm on the plate. I just turned my hand out and caught the plate. There was a space of an inch and a half and I got my hand in it. At the same time I let my machine drop. When this chord landed it did not land on the ground. It stood three or four feet in the air. I held on to the chord and never touched the ground.

Mr. HOLGATE.—You were in what chord?

Mr. BEAUVAIS.—No. 10, Montreal side. As soon as everything was still I came out. It was easy to stay there because I was tight in there. I had one leg broken and my nose was broken.

Mr. HOLGATE.—I fancy being inside the chord saved you?

Mr. BEAUVAIS.—I guess it did. I put my left foot outside the chord and my right foot in the chord.

Mr. HOLGATE.—Could you say where you first rose up at that point?

Mr. BEAUVAIS.—That is something I could not say. I could feel it drop like. I made a grab for the plate, I let the machine drop and I never felt this foot broken. It happened so quickly.

Mr. HOLGATE.—But the first sensation you had was of falling?

Mr. BEAUVAIS.—Yes, the first thing I felt was the falling, the dropping.

Mr. HOLGATE.—Was there any preliminary cracking or breaking noise around before that?

Mr. BEAUVAIS.—There was very little noise I heard. I heard no crack before it dropped. Of course, you could not hear much from the outside, where I was. I was right inside the chord.

Prof. GALBRAITH.—You are sure that the splices between 8 and 9, on both sides, were riveted up at that time?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—And that the one on the Quebec side between 9 and 10 was riveted up?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—And that the bending together of the two inside ribs was on chord No. 9?

Mr. BEAUVAIS.—On chord No. 9, Montreal side.

Mr. HOLGATE.—That was the most prominent part of the chord, and you cannot say that you noticed the same bending on the outside ribs?

Mr. BEAUVAIS.—Yes.

Prof. GALBRAITH.—How about the bending of chord No. 9 on the other side?

Mr. BEAUVAIS.—I could not say about the Quebec side. I passed very often while I was working on the Quebec side.

Prof. GALBRAITH.—You did not notice the bending?

Mr. BEAUVAIS.—I never noticed it.

Mr. HOLGATE.—What do you think now may have been the cause of those few rivets breaking out so soon after they were driven and so soon before the accident?

Mr. BEAUVAIS.—Any bridgeman can tell you that. The splice was like this (indicating with his hands). There are about four inches of plates there, and this outside plate here is not so thick; it would be perhaps one half or three-quarters of an inch in thickness; when the strain came it would be three or four inches over the joint. This is a powerful gun, and the jarring was so great that you could feel it under your feet.

Mr. HOLGATE.—Had you anything like that occur at any other point when you were riveting it up?

Mr. BEAUVAIS.—Yes, sometimes on account of a burnt rivet.

Mr. HOLGATE.—Was the breaking of these two or three rivets unusual? Were they good rivets?

Mr. BEAUVAIS.—I saw nothing wrong about them.

Mr. HOLGATE.—In fact, you thought it was so curious that you asked Meredith to come down and look at it?

Mr. BEAUVAIS.—It was not only for that, but it was for two things. It was to show him these bad holes and these rivets broken out. He did not think them very serious. He said that he had seen worse than that before. They were bending out towards Montreal right at the joint.

Prof. KERRY.—Do you think that it was that bending that made the joint plate break the rivets?

Mr. BEAUVAIS.—Yes, because you could see that come off very near an eighth of an inch. It was pretty near three-quarters of an inch, and it came off very near one-eighth of an inch. You could see it just very near the joint. The plate was off perhaps one-eighth of an inch.

Prof. KERRY.—You had drawn it up tight when you started to rivet with the bolts?

Mr. BEAUVAIS.—Yes, because it would not be easy driving without drawing them up tight.

Prof. KERRY.—So that during the time you were working that gap of one-eighth of an inch opened up?

Mr. BEAUVAIS.—It worked itself off. This bend went towards Montreal and this splice plate was on this side. It came off about one-eighth of an inch right below where these two rivets broke.

Prof. KERRY.—Right at the line of the splice ?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—Then the ends of the chords were not square opposite each other ?

Mr. BEAUVAIS.—They were brought up pretty near and pretty square-faced and it was down, maybe, a quarter of an inch.

Mr. HOLGATE.—No 10 ?

Mr. BEAUVAIS.—The lower chord was lower than the upper chord maybe one-quarter of an inch at the time I saw these two rivets broke.

Prof. KERRY.—The ribs lined up well but No. 10 was lower than the other.

Prof. GALBRAITH.—How did you match the holes ?

Mr. BEAUVAIS.—The holes were not so bad but we had to pin them. The holes were matched before we drove. At the start we had to pin almost every hole, while at the last there were very few holes we had to pin.

Prof. GALBRAITH.—Did the holes match when the end of No. 10 was a quarter of an inch below No. 9 ?

Mr. BEAUVAIS.—I should say they matched. But there were some holes we had to pin. Of course, it did not go down much. It might be less than a quarter of an inch.

Mr. HOLGATE.—What would resist that bend at the joint towards Montreal ? Would not the lateral bracing hold that in place to some extent?

Mr. BEAUVAIS.—The lateral was not so close. The lateral from the strut comes right outside the post. This splice is 7 or 8 feet below it.

Mr. HOLGATE.—Now, Mr. Beauvais, were there any other places on the lower chords that you noticed bending ?

Mr. BEAUVAIS.—No. I only heard of it but did not see it personally.

Mr. HOLGATE.—But others spoke to you about it ?

Mr. BEAUVAIS.—Yes.

Mr. HOLGATE.—On that occasion did you understand that they had seen the bends ?

Mr. BEAUVAIS.—Yes, it was this gang using the same kind of a gun I was using that was working on the bottom chord that spoke to me about it. They were stopping at the same house I was stopping.

Mr. HOLGATE.—Were there more than two guns of that size ?

Mr. BEAUVAIS.—Only two.

Mr. HOLGATE.—Was all the riveting done on the chord joints done with the big gun ?

Mr. BEAUVAIS.—You could only use these two on the inside rivets. On the outside rivets you could use ordinary guns.

Prof. KERRY.—Where were that gang working when they spoke to you about the other bend ?

Mr. BEAUVAIS.—The gang I am speaking of worked right on the lower chord of the cantilever arm on both sides from the main pier outwards to the 6th panel. I could not say at which joint they said the chord was bent.

Mr. HOLGATE.—Did the work seem to go on pretty well on the bridge ?

Mr. BEAUVAIS.—Yes, everything seemed to go off well; in fact we only lost one man before that this season. That was Joseph Ward.

Prof. GALBRAITH.—He fell off ?

Mr. BEAUVAIS.—Yes, on the 20th.

Mr. HOLGATE.—All the men in your gang lost their lives ?

Mr. BEAUVAIS.—Yes, except that John Williams. He left about six weeks before the accident. He got hurt on the leg and had to leave. He ought to have seen that No. 9 chord on the Montreal side was bent. Of course, he never said anything about it, but he should have seen it because he travelled over it as well as I did.

Prof. GALBRAITH.—Is he alive?

Mr. BEAUVAIS.—Yes.

Prof. KERRY.—What day did you see it bending?

Mr. BEAUVAIS.—I could not say.

Prof. KERRY.—A week before the accident?

Mr. BEAUVAIS.—Three or four days.

Mr. HOLGATE.—He said that he thought it was Tuesday.

Mr. BEAUVAIS.—While I was working on the Montreal side I was travelling on that Montreal side of the bridge all the time when I was going home or going to dinner. When I worked on the Quebec side of course I always travelled on the Quebec side along the chord.

Prof. GALBRAITH.—What other lower chord joints were not riveted at the time of the accident in the anchor arm?

Mr. BEAUVAIS.—Except the stubs both sides were not riveted. There was another gang which had been driving here, and I believe they were almost completed.

Prof. GALBRAITH.—About chord No. 5?

Mr. BEAUVAIS.—I could not say which. I know there was another gang driving there.

Mr. HOLGATE.—Do you remember who was in charge of that gang?

Mr. BEAUVAIS.—Napoleon LaHache.

Mr. HOLGATE.—Are they alive?

Mr. BEAUVAIS.—They are all gone.

Mr. HOLGATE.—Is there anything else you think of, Mr. Beauvais, of interest, that you know of yourself? I think you have already said that you have no knowledge of your own about any other chords being bent?

Mr. BEAUVAIS.—No, not to my own knowledge.

Mr. HOLGATE.—Except what you heard?

Mr. BEAUVAIS.—Oh, yes; I guess everybody heard that, too.

Mr. HOLGATE.—Did you come in contact much with Mr. Yenser? Did you have much to do with him?

Mr. BEAUVAIS.—Hardly anything. Whenever I had anything to do with the foreman I had to go to my foreman, Meredith, and he was supposed to go to Mr. Yenser, but if I ever saw Mr. Yenser before I came to Meredith I talked to him instead of Meredith.

Mr. HOLGATE.—How did you find Mr. Yenser?

Mr. BEAUVAIS.—He was the right man, I suppose. I could not see anything wrong about him. The level bracing connecting at panel point No. 9 on the inner arm was not riveted on either side. It was full of bad holes. Most of them were blind holes in each side. There were no bolts in it at all. They were just lying there.

Mr. HOLGATE.—No connection whatever?

Mr. BEAUVAIS.—No, they were blind holes, most of them.

Prof. GALBRAITH.—Do you know anything about the riveting in this long diagonal next the centre post marked on the plan T-5 and T-50?

Mr. BEAUVAIS.—I drove those myself.

Mr. GALBRAITH.—Was that riveting finished?

Mr. BEAUVAIS.—Yes, we finished on top before we came down. I started there and went up to the last post and I was ordered to come down to the bottom chord.

Prof. GALBRAITH.—What about the riveting of the centre post?

Mr. BEAUVAIS.—I could not say how much riveting there was done at that. I am pretty sure it was almost completed, though.

Prof. GALBRAITH.—If you have anything more to say that you think would be of use you might say it now.

Mr. BEAUVAIS.—There is only one thing—I do not know whether it is important or not. It was last summer. I am sure it was not less than 15 inches in length. It was about that wide (indicating)—almost semi-circular. It was broke off the main

post. It was almost at the shoe. We attempted to straighten that with the jack. It was cracked and bent right off and we had to send it to the blacksmith shop to get it straightened and put it back there with another plate.

Prof. GALBRAITH.—Is that the chord plate?

Mr. BEAUVAIS.—It was one of the webs of the main post—the angle web. That angle must have been 6 inches wide.

Prof. KERRY.—That was the piece right above the angle?

Mr. BEAUVAIS.—Yes, semi-circular; it came that way (indicating).

Mr. HOLGATE.—How did it get broken?

Mr. BEAUVAIS.—It was bent, and we were sent down there to straighten it out with the jack. We jacked it up and it broke right out. The piece came right out.

Mr. HOLGATE.—Did it fly out?

Mr. BEAUVAIS.—It did not fall off altogether, but it was split away open. It would have been easy to knock it out with a hammer.

Mr. HOLGATE.—Which side of the bridge was that?

Mr. BEAUVAIS.—On the Quebec side and on the Quebec side of the post, too.

Prof. KERRY.—How far above the shoe?

Mr. BEAUVAIS.—Ten or twelve feet.

Prof. KERRY.—It would be in the first section of the post right above the shoe?

Mr. BEAUVAIS.—Yes. We had to send that to the blacksmith shop to straighten it and we placed it back in position again and then another plate was put on—a patch.

Mr. HOLGATE.—It was a good solid patch that was put on?

Mr. BEAUVAIS.—I could not say what thickness it was.

Mr. HOLGATE.—You worked on it yourself?

Mr. BEAUVAIS.—Yes, sir, I helped to drill the holes in it.

Witness discharged.

Mr. HOLGATE, Chairman of the Commission, interviewed Oscar Lebarge, at his residence near the bridge.

OSCAR LEBARGE, sworn.

Mr. HOLGATE.—You are employed by the Phœnix Bridge Company?

Mr. LEBARGE.—Yes.

Mr. HOLGATE.—When did you start work on the Quebec bridge?

Mr. LEBARGE.—April, 1905.

Mr. HOLGATE.—What kind of work were you doing?

Mr. LEBARGE.—Everything. I worked all over the bridge.

Mr. HOLGATE.—In 1907, that is this season, what part of the bridge were you working at?

Mr. LEBARGE.—On the top of the big traveller.

Mr. HOLGATE.—Is that where Mr. Hall was working?

Mr. LEBARGE.—Yes.

Mr. HOLGATE.—You were working both together?

Mr. LEBARGE.—No, he was working on one side and we were working on the other. We worked together sometimes, but that time, when it fell, we were not together.

Mr. HOLGATE.—You were working on August 29 when the accident happened?

Mr. LEBARGE.—Yes.

Mr. HOLGATE.—Had you any warning of that accident at all?

Mr. LEBARGE.—I did not see it. I heard some fellow say the chord was bent, but I asked the foreman, and he said, 'Oh, no.'

Mr. HOLGATE.—Was there anything that happened that afternoon on the bridge at the traveller that caused you to feel insecure?

Mr. LEBARGE.—No.

Mr. HOLGATE.—Was there any swaying that you felt?

Mr. LEBARGE.—No.

Mr. HOLGATE.—Or any up and down motion that you felt?

Mr. LEBARGE.—Sometimes a slight motion like that (indicating), but I never paid any attention to it.

Mr. HOLGATE.—You did not think it any worse that day than any other day?

Mr. LEBARGE.—No.

Mr. HOLGATE.—I suppose when the bridge fell that is all you know about it, that you simply had to try and look out for yourself?

Mr. LEBARGE.—Yes.

Mr. HOLGATE.—You spoke just now of hearing about the chords. Did you ever have a chance to look at these chords yourself?

Mr. LEBARGE.—No, I never went to see it. I was working there on top of the big traveller when they put the big chord in.

Mr. HOLGATE.—Were you ever working with the rivetters?

Mr. LEBARGE.—Yes, I worked this spring with the rivetters.

Mr. HOLGATE.—Whereabouts?

Mr. LEBARGE.—On the third panel, I guess.

Mr. HOLGATE.—In the cantilever arm?

Mr. LEBARGE.—No, I do not know, I did not work there, I am not very sure, I do not think I worked on the cantilever arm, I worked on the anchor arm.

Mr. HOLGATE.—Was it on the posts or chords?

Mr. LEBARGE.—I worked on the posts, and I put some plates on the bottom chords and on the laterals, the bottom laterals.

Mr. HOLGATE.—Can you remember about what time you were working at the riveting, just in the month, say?

Mr. LEBARGE.—It was in April, April and May I was working there.

Mr. HOLGATE.—Can you recollect which chords you were working on?

Mr. LEBARGE.—No.

Mr. HOLGATE.—Were they near the main pier, that is the cantilever pier; did you work on any joints close to that?

Mr. LEBARGE.—Yes, I worked on one of the joints there one day, straight in there (indicating), that is in May. A fellow named Johnson and myself, the first strut down next the pier on the anchor arm, on the Montreal side.

Mr. HOLGATE.—The horizontal strut at panel point 9?

Mr. LABERGE.—Yes.

Mr. HOLGATE.—And you completed the joints at the intersection of the horizontal strut with the next post? Do you remember if that horizontal strut, this one here, was riveted up, the 9th panel point?

Mr. LEBARGE.—It was not then. At that time that strut in here was loose. It was connected, and then this one we could not connect, it was a little below.

Mr. HOLGATE.—Did you rivet that up later?

Mr. LEBARGE.—I do not know if he did rivet it.

Mr. HOLGATE.—You do not remember that the horizontal strut was riveted up on the 9th panel point? Can you recollect anything about the chords down on the anchor arm, from the pier up this way? Did you ever notice that particularly?

Mr. LEBARGE.—No, I never did.

Mr. HOLGATE.—Did you hear anything about that; was your attention called in any way to them?

Mr. LEBARGE.—I heard that a piece of the chord in there was bent, and I went to a fellow, Aderholdt—I was working for him—and I asked him, I said: 'Do you see that chord in there.' He says: 'Yes, that was bent when they put it in there.' He says: 'Don't you remember all the trouble they had to put it in?' I said 'No, I was not working then.' I do not think I was working, I did not work in the gang most

of the time, I was working on top of the traveller. This spring I worked on top of the traveller, doing the rigging.

Mr. HOLGATE.—Mr. Aderholdt did not mention what chord it was?

Mr. LEBARGE.—No, he never did. He told me it was a chord that was bent when they put it in. I did not ask what number it was; he said it was bent; he said they had all kinds of trouble to connect it when they did put it in.

Mr. HOLGATE.—Was he your foreman?

Mr. LEBARGE.—Yes, he was my pusher, we call him. These fellows get more money than we do; they get 7½c. more than we do by the union.

Mr. HOLGATE.—Did you know Yenser?

Mr. LEBARGE.—Yes, I know him; I worked with him on two different jobs; I worked here and I worked last winter, too.

Mr. HOLGATE.—Was he a pretty careful man on work?

Mr. LEBARGE.—He did some good work and sometimes he got excited, sometimes he got pretty good ideas, too.

Mr. HOLGATE.—How about the tackle that you used on the traveller, was that all right, the hoisting rigging?

Mr. LABERGE.—Oh, yes, that was first-class rigging in there.

Mr. HOLGATE.—Did anything ever go wrong with that?

Mr. LEBARGE.—No, we never broke anything; but a man got hurt by that rigging on top of the traveller.

Mr. HOLGATE.—It was always strong and heavy enough to do the work.

Mr. LEBARGE.—Yes, always good and strong, and kept in good order; everything first-class.

Mr. HOLGATE.—Did they follow up the riveting on the anchor arm as fast as they might have done? Did the riveting gangs follow up the erection as fast as they might have done?

Mr. LEBARGE.—I do not know as to that. They kept a pretty good gang of riveters driving right along this year; I cannot tell. They kept good bolts and everything; when they raised the iron they kept it bolted up pretty good; they bolted it up 50 per cent every place they put a piece on, you know. Some places they put bolts every hole.

Mr. HOLGATE.—Would you say that they were reasonably careful about doing all that kind of work?

Mr. LEBARGE.—I cannot tell that. They were good and careful in raising the iron and everything, but I do not know enough, on a big job like that, to know if they are taking care of what is going on behind. They were good and careful in front in raising the iron.

Mr. HOLGATE.—Did you see much of Mr. Kinloch on the work?

Mr. LEBARGE.—Oh, yes, Mr. Kinloch was standing there all the time.

Mr. HOLGATE.—Every place?

Mr. LEBARGE.—Oh, yes, he kept around there near every place. Yes, he knew; he had pretty good experience on other work.

Mr. HOLGATE.—And Mr. Birks?

Mr. LEBARGE.—Yes, Mr. Birks was there all the time; every time they raised a big piece like the tower Mr. Birks would go all around the traveller to see if everything was tight and safe.

Mr. HOLGATE.—When the bridge fell did it go down straight?

Mr. LEBERGE.—It went down for a piece, as far as I remember it went right down, and it kind of stopped then, and I do not know which way it went, because I left the position I was in; I remember I was going down, I was in the air, I was not holding anything, just holding a piece of timber. When it started I went right down, right straight down for maybe 75 feet, somewhere like that.

Mr. HOLGATE.—Were you on top of the traveller?

Mr. LEBARGE.—On top of the big traveller, standing up. When it started to go down, there were three pieces of timber 10 x 12 x 38 feet, and I was standing on two

of them, and it started to go down. I just touched the timber, my feet just lightly touched the top of the timber. The balance, the iron, was going faster than the timber, and the timber was going about the same as I was and I was just touching them, so I could not lay down to catch it because I was going too fast, and I was standing up, and when we were down 75 or 100 feet, I kind of stopped, so I remember my feet caught the timber, and as I was going down I had my arm around one of those pieces of timber. I remember I was in the water. When I hit the water I do not know where I hit or anything like that.

Mr. HOLGATE.—Did you manage to get out yourself or were you knocked senseless?

Mr. LEBARGE.—As soon as I hit the water, I got myself and I swam and caught up to some timber and I held on to it, and then I got into a skiff, there was a fellow there and he lifted my leg in and took me to the shore.

Witness discharged.

Prof. GALBRAITH and Prof. KERRY visited the house of Mr. Charles Davis, New Liverpool, and took his evidence.

Mr. DAVIS being sworn.

Prof. KERRY.—Where were you working on the bridge?

Mr. DAVIS.—I was right at the front, sir, right out on the end of it.

Prof. KERRY.—On what they call the little traveller?

Mr. DAVIS.—I was out on the last section.

Prof. KERRY.—Had you been with the company long?

Mr. DAVIS.—I worked all last summer with them.

Prof. KERRY.—1906 and 1907?

Mr. DAVIS.—Yes.

Prof. KERRY.—Where were you when the bridge went down?

Mr. DAVIS.—I was right out on the end. They had just put the section of the bottom chord in.

Prof. KERRY.—Tell us what you know about the bridge when it went down. Did you have time to notice anything?

Mr. DAVIS.—Not at that time. I heard a crash, something go away back on the bridge, and I felt it sink.

Prof. KERRY.—It went straight under your feet?

Mr. DAVIS.—Just straight down, sir.

Prof. KERRY.—You do not know anything more till after you got in the water?

Mr. DAVIS.—I do not remember anything striking me at all, but something must have with the injury I received on my back and hip.

Prof. KERRY.—You could not have got down without some of the wreckage striking you?

Mr. DAVIS.—No.

Prof. KERRY.—So that all you recollect is just that the bridge went down underneath you?

Frof. GALBRAITH.—Did it go very fast or very slow?

Mr. DAVIS.—Slow at first.

Prof. GALBRAITH.—Until it struck the water?

Mr. DAVIS.—It left me, sir. I was in space, in the air. It travelled a great deal quicker than I did.

Prof. GALBRAITH.—So that you struck only the water; you did not strike pieces of the bridge nor the beach?

Mr. DAVIS.—No. If the traveller had come down behind me it would have struck me. I stood on a section of the bottom chord when it started to go, I looked down and a good many thoughts were going through my mind. When it left me I was in space. It travelled a great deal quicker than I did.

Prof. KERRY.—You were working as an erector?

Mr. DAVIS.—Yes, sir.

Prof. KERRY.—Had you any reason to think that there was anything wrong with the bridge?

Mr. DAVIS.—I heard them talking every day. A great many of the men thought the chord was buckling.

Prof. KERRY.—You did not have a chance to look at it yourself?

Mr. DAVIS.—I was driving rivets the day before the accident and on the splice lower down, next to where we were on the cantilever arm the jacks were in position to jack the webs which were buckling. Mr. Yenser and Meredith, the riveter foreman, had been down looking at it. When they went away I wondered what was wrong, seeing the jacks in between the webs.

Prof. KERRY.—That would be how many joints away from the pier?

Mr. DAVIS.—Five or six, I should say—six or seven. I could hardly say now.

Prof. KERRY.—That is on the——

Mr. DAVIS.—Quebec side.

Prof. KERRY.—They had the jacks in between the webs trying to straighten them up?

Mr. DAVIS.—To straighten them out.

Prof. KERRY.—That was just because they did not line up truly?

Mr. DAVIS.—Yes, I expect so.

Prof. KERRY.—So that you could not get the plate on right?

Mr. DAVIS.—Yes, sir.

Prof. KERRY.—That was the only thing you saw yourself?

Mr. DAVIS.—I had seen the cracking of the plate on the shoe.

Prof. KERRY.—Did you see that?

Mr. DAVIS.—Yes.

Prof. KERRY.—Which plate was that?

Mr. DAVIS.—It would be the plate connected with the portal strut and bottom chord that is connected into the shoe. I really do not think that it would be any cause at all of the disaster.

Prof. KERRY.—That is a big flat plate?

Mr. DAVIS.—Yes.

Prof. KERRY.—Which is just shaped to a V?

Mr. DAVIS.—Fastened to the shoe, and diagonally running across.

Prof. KERRY.—Where was that cracked?

Mr. DAVIS.—Just alongside of the bottom chord—the chord connecting with the shoe.

Prof. KERRY.—A chord on the anchor arm?

Mr. DAVIS.—Yes. That would be on the Montreal side.

Prof. KERRY.—What sort of a crack was it?

Mr. DAVIS.—About 18 inches to 2 feet, I would say.

Prof. GALBRAITH.—Could you see daylight through it?

Mr. DAVIS.—I could not say, but it seemed pretty brittle.

Prof. KERRY.—How close could you get to it?

Mr. DAVIS.—You could get right at it.

Prof. KERRY.—Did you feel it with your hand at all?

Mr. DAVIS.—No, I just looked at it. I heard them speak of it. A man named Callahan and I were driving rivets near the Quebec post and we went down and had a look at the chord on the pier.

Prof. KERRY.—It was there all right?

Mr. DAVIS.—Yes.

Prof. KERRY.—About 18 inches long?

Mr. DAVIS.—Yes, I dare say it would be.

Prof. KERRY.—And quite close to the connection with the shoe.

Mr. DAVIS.—Yes, sir.

Prof. GALBRAITH.—Are you sure it was not a fold in the metal done in the blacksmith shop?

Mr. DAVIS.—Sure. I know the difference between a crack and a crimp.

Prof. KERRY.—How wide would it be?

Mr. DAVIS.—There was no width at all. It was only just cracked.

Prof. GALBRAITH.—Crooked or straight?

Mr. DAVIS.—Straight.

Prof. KERRY.—Was there an angle outside?

Mr. DAVIS.—Yes. The plate was bolted and fastened to the bottom chord.

Prof. KERRY.—Was there an angle outside the plate, or was it just flat?

Mr. DAVIS.—No, I do not think there was an angle at that point.

Prof. KERRY.—Did you see anything else you think of?

Mr. DAVIS.—I do not think I saw anything else at all.

Prof. GALBRAITH.—When did you see that crack?

Mr. DAVIS.—That would be early in June, I should say.

Prof. GALBRAITH.—Did Mr. Yenser, as far as you heard, know anything about it? Do you know if anyone told Mr. Yenser about it?

Mr. DAVIS.—I could not say, but Callahan, my partner who worked with me, said that he would tell Meredith, the riveting foreman, about it.

Prof. GALBRAITH.—Did you feel the bridge more springy than usual at the time of the accident or before the accident?

Mr. DAVIS.—No, I could not say I did. I never felt anything at all.

Prof. KERRY.—It just came when you were not looking for it?

Mr. DAVIS.—It just came unexpected. I never expected anything of the kind, or else I should not have been there for one.

Prof. GALBRAITH.—Did any man speak to you about the bridge being dangerous about that time?

Mr. DAVIS.—Yes, Brind, another man, and also his brother-in-law, Smith, were speaking of it going up to work—that they had seen Yenser and Birks examining a chord.

Prof. GALBRAITH.—Where do you say that chord was?

Mr. DAVIS.—On the Quebec side; what I saw the jacks in. I do not know any other part of the chord.

Prof. GALBRAITH.—About what panel?

Mr. DAVIS.—It would be the 7th or 8th chord.

Prof. GALBRAITH.—You understood, in your evidence before, that it was five or six panels?

Mr. DAVIS.—That is where we were driving rivets. We were driving rivets next to this point where we had the jacks in position. I could not say for certain what panel it would be in. We were up a pretty good way. At that point they were driving rivets the day before the bridge collapsed.

Prof. GALBRAITH.—Do you think that good care was exercised in handling and erecting?

Mr. DAVIS.—Yes, sir, I do really. What I have seen of everything there I always thought it was first-class—what they had in regard to tackle, tools and all that.

Prof. GALBRAITH.—You saw no, what you would call unnecessary risks taken during the erection?

Mr. DAVIS.—No, I did not.

Witness discharged.

Commission adjourned.

NINTH DAY.

QUEBEC, Wednesday, September 18, 1907.

The Commissioners visited the storage yard of the Phœnix Bridge Company at Belair and the works on the north side of the river, devoting the entire day to a personal examination of the work and material.

TENTH DAY.

QUEBEC, Thursday, September 19, 1907.

The Commissioners spent the day at the wreck on the south shore, and made an examination of the different points referred to in the evidence.

ELEVENTH DAY.

QUEBEC, FRIDAY, September 20, 1907.

The Commission resumed at ten a.m. in the Court House.

RAOUL LAFRANCE, recalled.

(Evidence given in French, and translated by Mr. Stuart.)

Mr. HOLGATE.—You were instructed to go on the ground with Mr. Kinloch and Mr. McLure, and endeavour to find the plate referred to in your evidence?

Mr. LAFRANCE.—Yes, I went.

Mr. HOLGATE.—Did you find the plate?

Mr. LAFRANCE.—No, there was no means of doing so. There was too much iron on it. It is all in ruins. There is no means of finding it.

Mr. HOLGATE.—You marked on a photograph (Exhibit No. 29) the plate that you referred to in your evidence as being cracked? Did you find that plate?

Mr. LAFRANCE.—No, sir. (The remainder of Mr. Lafrance's evidence was translated by Mr. French.)

Mr. HOLGATE.—Will you say that the plate you marked on the photograph is not to be found in the wreck?

Mr. LAFRANCE.—I cannot find it. There is no way of finding it.

Mr. HOLGATE.—How long were you there looking for this plate?

Mr. LAFRANCE.—I was about three-quarters of an hour looking for it.

Mr. HOLGATE.—Did you see other parts of the bridge that were connected up to this plate?

Mr. LAFRANCE.—No.

Mr. HOLGATE.—Were all the parts that were connected up to this plate also missing?

Mr. LAFRANCE.—There was no way of seeing anything—any parts of it. I only saw one piece and it was so much broken up that I could not recognize it well.

Mr. HOLGATE.—Who was with you when you made this inspection?

Mr. LAFRANCE.—I was alone. Mr. Kinloch was down below, and there were others there present whose names I do not know.

Mr. HOLGATE.—I understand, Mr. Lafrance, that these parts that you referred to are still there and can be inspected?

Mr. LAFRANCE.—I have not been able to find them anyway. I do not know the different parts of the bridge well enough to recognize the parts, to distinguish them from the other. I was not there long enough for that.

Mr. HOLGATE.—Why did you not stay long enough?

Mr. DAVIDSON.—I think he means he was not working on the bridge long enough to be familiar with them.

Mr. HOLGATE.—Is that what he means?

Mr. LAFRANCE.—Yes, that is what I say. I was not on the bridge long enough to be able to distinguish the different parts of the bridge.

Mr. HOLGATE.—I wish he would clear that up. The plate he marked is there.

Mr. DAVIDSON.—That is not a photograph of the plate he marked at all.

Mr. HOLGATE.—It is one of a plate on the corresponding side?

Mr. DAVIDSON.—Exactly, but it is not the one. Mr. Haley tells me that in the mass of ruins there, in his opinion, it would be absolutely impossible for any one to find it.

Mr. STUART.—Any one that knows anything about it would be able to.

Mr. DAVIDSON.—I dare say that a bridgeman or an engineer might find it, but that is quite a different thing.

Mr. HOLGATE.—We will dismiss this witness and trust to our own examination.

Mr. STUART.—I guess you will not get any more information from him.

Witness discharged.

Mr. KINLOCH, recalled.

Mr. HOLGATE.—Mr. Kinloch, will you please give us the history of what took place on August 29 expressly in reference to the fall of the structure and what you actually observed?

Mr. KINLOCH.—My attention was first called by a noise; as near as I could describe the noise it would be like a car running over a stick of timber—the crunching sound of timber—not very loud; in fact, I would not have paid any attention to it if it had not continued. I was just entering the office of the Phœnix Bridge Company and the noise continuing I looked out from the door and saw the end post trembling. I knew something was wrong and I ducked my head and looked up to see the portal. It was inclined slightly away from me and trembling.

Prof. GALBRAITH.—That is at the anchor pier?

Mr. KINLOCH.—That was at the anchor pier, yes, but at the end post.

Mr. HOLGATE.—Could you notice any change in the position of the posts eastward or westward?

Mr. KINLOCH.—No, sir, they seemed to be perfectly straight as far as that was concerned, only leaning over and slowly sinking.

Mr. HOLGATE.—We understand that you were standing on the platform near the office.

Mr. KINLOCH.—I was just turning in the door.

Mr. HOLGATE.—Just describe where you were, Mr. Kinloch, as shortly as you can; state whether it was east or west of the railway track and how far from it? Can you indicate on this plan (referring to Exhibit No. 25) about where you were at the time of the accident?

Mr. KINLOCH.—I was standing at point X on the southerly abutment shown on plan 25.

Mr. HOLGATE.—You might just repeat, Mr. Kinloch, what you saw.

Mr. KINLOCH.—Standing at that point I first heard the noise and then saw the post trembling, and then I had to stoop down a little bit to look for the portal strut.

Prof. KERRY.—Which post trembled ?

Mr. KINLOCH.—The end post.

Prof. GALBRAITH.—Which side ?

Mr. KINLOCH.—The Quebec side.

Prof. GALBRAITH.—On the right hand side ?

Mr. KINLOCH.—Yes. I could not see the other post. I stepped outside of the door and the same motion was continued. It was slowly sinking and the last clear recollection I have of anything was seeing the two centre post peaks slowly settling straight down in about the same position that they always stood in regard to the line of track. They did not seem to be east or west towards Montreal or Quebec ; they seemed to be about the same as the rest of the bridge. I did not notice any bulging out one way or another. About that time I turned my back to it and did not look at it any more. I should judge then that the portal strut would be about 10 feet above the deck just at a rough guess.

Prof. GALBRAITH.—When you turned your back ?

Mr. KINLOCH.—Yes.

Prof. GALBRAITH.—The portal had gone over ?

Mr. KINLOCH.—It inclined towards the river.

Prof. GALBRAITH.—Northerly ?

Mr. KINLOCH.—Northerly.

Prof. GALBRAITH.—How were the main posts?

Mr. KINLOCH.—When I last saw them, or the last recollection I had of them, the main posts were standing in their same relative positions ; they looked to be the same distance apart and there was no difference in the height and they seemed to be tied together with the struts and bracing and they seemed to be slowly settling down.

Prof. GALBRAITH.—You could not see them toppling towards the river ?

Mr. KINLOCH.—No, sir.

Prof. GALBRAITH.—They were foreshortened and seemed to be sinking ?

Mr. KINLOCH.—Just the same as if they had been ice and were melting off at the bottom.

Mr. HOLGATE.—When you did look up again, as I suppose you did immediately afterwards, what did you observe particularly ?

Mr. KINLOCH.—It was all down. I did not pay much attention to the wrecked span right off. I looked at the other span to see in what shape it was.

Mr. HOLGATE.—The approach span?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—Were any rails or other materials dragged off the approach span?

Mr. KINLOCH.—They were pulled some. They pulled the spikes along with them. What I examined, when I said I made an examination of the approach span, was the lower legs to see if anything had happened to them, because I knew there would be a lot of people there, and I did not want it to go down on top of them.

Prof. GALBRAITH.—Of course, that examination took a little time?

Mr. KINLOCH.—No, not very long, because I immediately made up my mind that there was nothing wrong with it. I looked at it and saw that nothing had hit it, and I did not take any time with it. I do not know how long it did take, but it did not take very long.

Prof. GALBRAITH.—Did you observe any crumpling up of the sway bracing?

Mr. KINLOCH.—No, sir.

Prof. GALBRAITH.—Could you tell whether the tension chords—the top chords—straightened out or slackened during the fall?

Mr. KINLOCH.—No, sir.

Prof. GALBRAITH.—You saw no particular indications as to the place where the initial fracture occurred?

Mr. KINLOCH.—No, sir, not while it was falling.

Mr. HOLGATE.—Did you notice any apparent rise in any portion of the structure during the fall?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—I understand that you were engaged as inspector on the work and that you were there before the erection began?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—And continuously during its erection?

Mr. KINLOCH.—All except for about four weeks—the two times I was home to see my father, when he was sick and when he died; practically continuously—yes.

Mr. HOLGATE.—Commencing with the erection of the work, did you observe at any time defects in metals or material which required to be rectified?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—You might give us a description of those that you observed and had to deal with yourself.

Prof. GALBRAITH.—In order if you can.

Mr. KINLOCH.—About the first thing, I guess, that came up was on the setting of the pedestals. We found the masonry had not been dressed quite true, or at least there were little humps sticking up in it. It was rectified by taking the pedestals up and dressing the stone down true. Upon setting the Quebec shoe there was a warp discovered in the shoe—on the east half of the shoe where it did not fit down to the pedestal. Mr. McLure has a record of the actual measurement of it, and I think he could give it better than I could. But my recollection of it is that the maximum part of it was about $\frac{1}{8}$ of an inch.

Mr. HOLGATE.—Mr. McLure can give us those details?

Mr. KINLOCH.—Yes, he has the record of them.

Prof. KERRY.—Where do you make the dividing line between the pedestal and the shoe?

Mr. KINLOCH.—There is a lower pedestal and an upper pedestal. The pedestal is in four sections, the upper and lower pedestal, and then comes the shoe.

Mr. HOLGATE.—Yes?

Mr. KINLOCH.—I do not know whether I can get these quite in order or not.

Prof. GALBRAITH.—As near as possible.

Mr. KINLOCH.—About the next thing that was noticed were these bends in the different chord members, particularly in No. 1, No. 2 and No. 3 of the anchor arm.

Mr. HOLGATE.—Which side?

Mr. KINLOCH.—On the Quebec side.

Mr. HOLGATE.—Tell us what these were?

Mr. KINLOCH.—They were irregular bends in the chords; that is, we would look along the chord, and it would not look straight. I never measured them to know exactly what they were, and I do not know exactly whether they were ever measured or not. I took it up with Mr. McLure and Mr. Birks, and we decided that they were of no importance. A number of other chords that I never paid any attention to were about the same way. There were wavy bends, in and out. I should judge, just guessing at it, that probably the biggest one of them would not be over half an inch.

Prof. GALBRAITH.—These bends were observed before the bridge stress came on?

Mr. KINLOCH.—Yes, before anything was set up. Just the chord was laid.

Prof. GALBRAITH.—They were shop bends?

Mr. KINLOCH.—Yes, they were just as the chord had come from the yard.

Mr. HOLGATE.—These chords are made up of four ribs, are they not?

Mr. KINLOCH.—Yes.

Mr. HOLGATE.—Were all four ribs in just the same shape?

Mr. KINLOCH.—No, the centre rib might be bent in at one place and the outside rib might be bent out a little bit or it might not be in the same place. They were not regular bends; that is, they were not altogether in one way. They were just irregular and occurred at different places.

Mr. HOLGATE.—Then it was not a regular bending of the whole member?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Was any action taken to rectify this?

Mr. KINLOCH.—Not that I know of.

Mr. HOLGATE.—Were these particular ones now that you speak of, Nos. 1, 2 and 3 on the Quebec side on the anchor arm, known to others besides yourself?

Mr. KINLOCH.—Mr. McLure and Mr. Birks knew of them.

Mr. HOLGATE.—Anybody else?

Mr. KINLOCH.—Mr. Hoare.

Mr. HOLGATE.—Anybody else?

Mr. KINLOCH.—I do not know myself of anybody else.

Mr. HOLGATE.—Did Mr. Yenser.

Mr. KINLOCH.—Yes, Mr. Yenser knew.

Prof. GALBRAITH.—These were looked upon as minor defects which would not in any way affect the strength or stability of the bridge?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Go on, Mr. Kinloch.

Mr. KINLOCH.—There was a question that came up about certain points being accessible to paint that were put up. That was taken up just about that time. That was taken up with Mr. Hoare and Mr. Deans, and Mr. Deans was to provide some way to put more holes in there so as to get in there to paint. Also, in the matter of rivets in connection with the erection I looked over their list and I found they had what I considered a rivet which was too short for the standard Boyer snap, and it was agreed between Mr. Deans and myself that they would furnish rivets for the standard Boyer snap, and they were furnished.

Prof. GALBRAITH.—The rivets were too short?

Mr. KINLOCH.—They were too short for the standard Boyer snap. They were all old style rivets for the old style snap.

Mr. HOLGATE.—First of all in regard to making parts accessible for paint, what holes do you refer to?

Mr. KINLOCH.—There is a large lateral plate on the bottom chord, there are two bottom cover plates and the top has cover plates also and there is a diaphragm, and it is impossible to get inside of the centre webs to do any painting without cutting a hole in there so as to be able to get your hand in there or some portion of the body or a swab, or a small hole to use a spray.

Mr. HOLGATE.—In what parts were these holes placed?

Mr. KINLOCH.—They were never placed. They were placed in the suspended span, but not in the anchor or cantilever arm.

Prof. KERRY.—The point of controversy was that the chord members near joints could not be kept in proper condition by cleaning and repainting owing to their method of construction?

Mr. KINLOCH.—Yes.

Mr. HOLGATE.—How far had the riveting work advanced before you found you had to make this change?

Mr. KINLOCH.—It had not advanced at all. The only riveting that was being done was a little bit on the tower shell and we stole the rivets from farther ahead and used them.

Mr. HOLGATE.—And the riveting was done on the revised plan which you suggested?

Mr. KINLOCH.—Yes, sir. About this time——

Mr. HOLGATE.—What time?

Mr. KINLOCH.—When they were laying the first chord.

Prof. GALBRAITH.—You might give approximately the date.

Mr. KINLOCH.—It was along between July 20 and 30.

Mr. HOLGATE.—What year?

Mr. KINLOCH.—1905.

Mr. HOLGATE.—Yes.

Mr. KINLOCH.—No. 9-L chord in the anchor arm was repaired in the yard.

Mr. HOLGATE.—Can you speak personally about these repairs?

Mr. KINLOCH.—Yes, sir. It was repaired before they started to raise there.

Mr. HOLGATE.—When was it, in your recollection, repaired—the same season?

Mr. KINLOCH.—Yes, it was the same season; it was in the month of July; I am pretty sure of that.

Mr. HOLGATE.—Somewhere about July it was repaired?

Mr. KINLOCH.—Yes, sir, because I came there about the first day of July and it was repaired and the ninth chord was there on August 24.

Mr. HOLGATE.—Which No. 9 chord was that?

Mr. KINLOCH.—9-L in the anchor arm.

Mr. HOLGATE.—Just tell us about these repairs.

Mr. KINLOCH.—The repairs consisted of the splicing of two angles that were broken and the addition of a new coverplate and cutting off some lacings and putting them back on again.

Mr. HOLGATE.—Were the repairs done to your satisfaction?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Did anybody else besides yourself inspect those repairs?

Mr. KINLOCH.—Mr. Hudson. Mr. Hoare, also, was over there.

Mr. HOLGATE.—What was Mr. Hudson's position then?

Mr. KINLOCH.—He was assistant engineer for the Phœnix Bridge Company, but he had charge of all the erection. He got up plans for the big travellers and he was here supervising the installation of the erection plant.

Mr. HOLGATE.—Was he Mr. Birks' predecessor?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Mr. Hoare also inspected these repairs?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—You inspected 9-L previous to the starting of the repairs yourself?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—What was the actual damage done to that member?

Mr. KINLOCH.—All I saw was that the plate was destroyed, but the two angles——

Prof. KERRY.—That is the cover plate?

Mr. KINLOCH.—Yes, the bottom cover plate.

Prof. KERRY.—The bottom cover plate was pulled off?

Mr. KINLOCH.—Or the top cover plate—I forget which one of them. It had fallen and the two side splice plates had sheared the angles off on the bottom—sheared and broken them together and we cut them off back to a good square bearing, back far enough so that they were square, added an angle, reinforced it with metal and put on extra plates.

Prof. KERRY.—So that the actual damage consisted in the wrecking of one cover plate and the shearing off of one leg of the angles on two ribs?

Mr. KINLOCH.—No, it cracked through the other leg.

Prof. KERRY.—There was no detectable injury to the webs of the chord there at all?

Mr. KINLOCH.—None that I could see. There was an old bend in there that had been put in there evidently in the shop by a chain and that was allowed to remain there. It could not be taken out anyway without heating it or cutting the rib apart. It was not any worse than some of the other bends in the chord, but it showed up because it bent in towards the other rib.

Prof. KERRY.—Which rib was this kink in?

Mr. KINLOCH.—With the chord in position in the bridge it would be the west centre rib.

Prof. KERRY.—What was the damage to the lacing, Mr. Kinloch?

Mr. KINLOCH.—The upstanding leg was bent down on the other leg. After the fall it continued on that side and just crumpled them down on the other leg.

Prof. KERRY.—And these lacings were cut off?

Mr. KINLOCH.—Yes, and new ones put on.

Prof. KERRY.—What was the extent of the bend in the rib—about half an inch?

Mr. KINLOCH.—Yes, I would say half an inch. It was very short and very shallow.

Prof. KERRY.—It did not go down any distance?

Mr. KINLOCH.—No.

Prof. KERRY.—Just at the edge?

Mr. KINLOCH.—Yes.

Prof. GALBRAITH.—The upper edge or the lower?

Mr. KINLOCH.—The upper edge.

Prof. GALBRAITH.—Whereabouts in the chord was this bend?

Mr. KINLOCH.—About 15 feet from the field splice at the 8 and 9 end.

Prof. KERRY.—You were satisfied, after the repairs, that the chord was straight?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Any wave in excess of how much would be readily detectable by the eye? Could you see half an inch very clearly?

Mr. KINLOCH.—Yes, I think so. I could see a quarter of an inch.

Mr. HOLGATE.—That is 9-L?

Mr. KINLOCH.—9-L.

Mr. HOLGATE.—That is the only chord you have referred to on the left hand side, so far.

Mr. KINLOCH.—There were others bent too, but just slight like 1, 2 and 3.

Mr. HOLGATE.—Which others were they?

Mr. KINLOCH.—I do not know now. I did not pay much attention to them.

Mr. HOLGATE.—That is on the left side?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Did you notice anything out of the ordinary in 10-L?

Mr. KINLOCH.—Anchor arm?

Mr. HOLGATE.—Anchor arm.

Mr. KINLOCH.—No, I am not sure I remember anything now.

Mr. HOLGATE.—Take the right hand side. You have already spoken of 1, 2 and 3; were there any others that your attention was drawn to?

Mr. KINLOCH.—There were others that had slight bends in them, the same as 1, 2 and 3.

Mr. HOLGATE.—Was there any one that your attention was drawn to more than another?

Mr. KINLOCH.—No, I do not think there was, but 1, 2 and 3 were the first in there and after that I did not pay much attention to them unless they were bad. If they were bad I would have noticed them.

Mr. HOLGATE.—The remarks you made in regard to your estimation of these chords, 1, 2 and 3, apply to the other lower chords on the right hand side of the anchor arm.

Mr. KINLOCH.—Some of them were a lot straighter than 1, 2 and 3. In other words, I could not say that there was a chord straight—absolutely straight—on the whole bridge. That is the ribs, you know. There might be a straight rib and there might be a slight bend. Some of these bends were very slight.

Prof. KERRY.—Within what deflection would you say they were straight?

Mr. KINLOCH.—Within half an inch.

Prof. GALBRAITH.—You do not expect in any species of construction to get things absolutely straight?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Now, you have come to the centre post. Have you anything to say in reference to similar matters beyond chord 10 on the anchor arm?

Mr. KINLOCH.—That is the last chord in the anchor arm.

Mr. HOLGATE.—But beyond chord 10 ?

Mr. KINLOCH.—In the cantilever arm ?

Mr. HOLGATE.—Yes, following out on the bridge.

Mr. KINLOCH.—I would say about the same condition existed out there ; matters were about the same.

Mr. HOLGATE.—Was there anything then discovered by you which, in your opinion, was not good shop practice ? What I mean by that is the fabricated material that you received ; did you consider it well put together and in as good condition as you might expect to receive it in from the manufacturer ?

Mr. KINLOCH.—In a general way, yes.

Mr. HOLGATE.—Then are we to assume that in some details it was not ?

Mr. KINLOCH.—There were some little things, I suppose, that had slipped through the shop.

Mr. HOLGATE.—What were they ?

Mr. KINLOCH.—They were mostly trivial things. An angle would have borings behind it or something and had not been bolted up, and it would have to be drilled or reamed.

Mr. HOLGATE.—Were there any blind holes ?

Mr. KINLOCH.—A few—remarkably few, though, considering the job. There are always more or less blind holes on any job.

Mr. HOLGATE.—Are these matters on record ?

Mr. KINLOCH.—I think there are; yes, sir.

Mr. HOLGATE.—Who would have these records ?

Mr. KINLOCH.—Mr. McLure.

Mr. HOLGATE.—In the shipment and handling of fabricated material such as this, is there any liability to injury by deforming the parts from careless loading as a general rule ?

Mr. KINLOCH.—No, I do not think so as a general rule. There might be some things that would be, but as a general rule it would not be.

Mr. HOLGATE.—Could you attribute anything in this case to careless loading ?

Mr. KINLOCH.—I do not remember any instance where anything was damaged, in my opinion, by careless loading.

Mr. HOLGATE.—Would you say the loading and the transportation had been carefully done ?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Generally speaking, is it not a fact that even with careful shop inspection loose rivets are discovered in members before erection occasionally ?

Mr. KINLOCH.—Yes, sir, and especially on a big work like this where you drive the field splices you are pretty apt to loosen up some of the rivets that are next to them.

Mr. HOLGATE.—What have you to say as to the condition that you know the shop riveting to have been in ?

Mr. KINLOCH.—Generally good.

Mr. HOLGATE.—Did you ever have to make any complaints about the shop riveting?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Then, your inspection was complete enough to have fully informed you?

Mr. KINLOCH.—I did not test all the shop rivets; in fact, I did not test any of them, only those that would come next to the splices I was driving in the field myself. I am speaking from appearances when I say that.

Mr. HOLGATE.—You saw nothing to lead you to suspect loose rivets?

Mr. KINLOCH.—No, sir; that is as a general thing. Once in a while I would find a loose rivet and a bad rivet.

Mr. HOLGATE.—In the shop riveting?

Mr. KINLOCH.—In the shop riveting.

Mr. HOLGATE.—Was that more or less than you might ordinarily expect in heavy work?

Mr. KINLOCH.—I would say about the same.

Mr. HOLGATE.—Would you look for more in very heavy work than in lighter work?

Mr. KINLOCH.—Certainly.

Mr. HOLGATE.—Have you ever had as heavy work pass through your hands?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Did you find any more in this work than you did in any other work that has passed through your hands?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—What are we to understand from that? Would you say that due care had been taken in the riveting and in the inspection at the shop?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—The chord ribs were built up of parallel plates. Have you noticed anything at any time to indicate whether the surfaces of these parallel plates were dry when they were riveted together or oiled?

Mr. KINLOCH.—Before or since the wreck?

Prof. KERRY.—At any time.

Mr. KINLOCH.—I would say they were painted before they were riveted together.

Prof. KERRY.—Have you evidence that the paint was fully dry before they were riveted together?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Or have you evidence to the contrary?

Mr. KINLOCH.—Evidence to the contrary?

Prof. KERRY.—From what you say and you know there were parts of the surfaces in contact that had liquid oil paint in between them?

Mr. KINLOCH.—It is customary in all shops to do that.

Prof. KERRY.—You say that that is the general shop practice, Mr. Kinloch?

Mr. KINLOCH.—Yes, what shops I have been in.

Prof. KERRY.—What is the reason for it?

Mr. KINLOCH.—Economy, I guess; to get the work out; that is all.

Prof. KERRY.—Why should the surfaces be painted with oil paint?

Mr. KINLOCH.—To keep them from rusting.

Prof. KERRY.—Have you any experience in your work as an inspector to justify that practice?

Mr. KINLOCH.—Yes, sir, only I think it ought to be dried before it was put together.

Prof. KERRY.—Do you mean to say that you have, in inspecting bridges, come across cases where the joint between two parallel plates riveted together has been badly rusted in between the plates?

Mr. KINLOCH.—Not between plates so much as between angles and plates.

Prof. KERRY.—When you mentioned that word 'economy' did you mean that in order to get the work out quickly it was customary to paint it and rivet it up without waiting for the paint to dry?

Mr. KINLOCH.—That is the general practice in all the shops. They paint their work and they do not give it time to dry, because if they did the different members would be scattered all over and they would have to bring them all together; so they usually paint it as the work goes on.

Prof. KERRY.—In order not to have material delayed in passing through the shop?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Referring again to your work as an inspector, Mr. Kinloch, would you consider it possible under ordinary shop methods to completely fill a rivet hole?

Mr. KINLOCH.—It would depend on the hole.

Prof. KERRY.—For example a hole fastening together four half-inch plates?

Mr. KINLOCH.—It would depend on whether the hole was straight or crooked and whether it had any offsets in it or had been reamed.

Prof. KERRY.—Your general observation has been that such holes are completely filled or not ?

Mr. KINLOCH.—It depends on the place. If it is a good straight hole and the rivet is short it will fill it, and it will fill a moderately long hole, but if the plates are not matched, if there is even the least little bit of an offset, it will project more at the end it is driven from than the other end ; it gradually grows less from the driven end towards the head.

Prof. KERRY.—Had you any opportunity to observe the riveting done on this work ?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—How did you find such rivets as you had to cut out ?

Mr. KINLOCH.—About the condition I had described.

Prof. KERRY.—That they were filled at the end and slack towards the centre.

Mr. KINLOCH.—If they were in that kind of a plate.

Prof. KERRY.—If they were through a bad plate. To what extent did you find pieces in which the preliminary work in the assembling had been inaccurately done?

Mr. KINLOCH.—I do not know as I ever found any. In assembling in the shop a thing may be just a little off and if steel like this with five or six plates falls off one-sixth of an inch, it is much worse than a quarter of an inch in ⅞ or ⅞ plates, so far as getting a drift pin or anything through to make your hole, is concerned.

Prof. KERRY.—Have you come across instances in cutting out any of the riveting on the bridge here, in which the hole was not true ?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—To any considerable extent ?

Mr. KINLOCH.—No, not very much.

Prof. KERRY.—When you say that there were some inaccuracies in the punching of the plate, was that to an extent in any way unusual in good work ?

Mr. KINLOCH.—I would say it was better than most work.

Prof. KERRY.—Better than the average work ?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And the punching for the field rivets would be a fair indication, would it not, of the accuracy of the same work on the parts that were shop driven? That is to say a plate which is being driven for both field rivets and shop rivets is punched at the same time completely.

Mr. KINLOCH.—No, I do not think it was in this case.

Prof. KERRY.—It was not ?

Mr. KINLOCH.—No, I think not in some cases, especially the chord members, they were drilled from the solid after the member was riveted together. So I understand, I do not know that personally.

Prof. KERRY.—In putting in the field rivets did you find in general that the holes agreed thoroughly ?

Mr. KINLOCH.—Not always, no, sir.

Prof. KERRY.—Due to the difficulties in the changing length of the members or due to shop work ?

Mr. KINLOCH.—Well, the holes on this bridge were different from any other bridge, that is it was continually changing, the panel lengths and the holes were pretty nearly all bad on the start.

Prof. KERRY.—That was on account of conditions ?

Mr. KINLOCH.—That is on account of the chamber in the span, the method of erection.

Prof. KERRY.—You would not know any way in which that could have been avoided ?

Mr. KINLOCH.—No, not at the start. Of course there was the usual number of

holes that were bad when the span came together, and they were supposed to be right as they would on any other span.

Prof. KERRY.—The work was up to good average practice?

Mr. KINLOCH.—Yes, some places we would have evidence that the holes were bad, may be two, four or five joints you would not have a bad hole, you could drive every hole in the joint.

Prof. KERRY.—The practice was to ream out all bad holes, previous to riveting?

Mr. KINLOCH.—If they were bad enough to require reaming.

Prof. KERRY.—But where the inaccuracy was small you simply straightened it out with drift pins?

Mr. KINLOCH.—Drift pins, yes, sir.

Prof. KERRY.—Do you consider that the amount of field riveting required on this work was the least that could have been made necessarily?

Mr. KINLOCH.—I am not an engineer, I do not pretend to answer that question.

Prof. KERRY.—Are you of the opinion that any of the joints that you had to rivet up in the field could have been riveted up in the shop?

Mr. KINLOCH.—I never paid much attention, I do not think they could rivet much more in the shop than they did.

Prof. KERRY.—That is to say they reduced the number of field rivets to the minimum?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And the inspection of the field rivets was very close, that was your personal duty, was it not?

Mr. KINLOCH.—Yes, that was my personal duty. Well, I have my own standard, I do not know what you——

Prof. KERRY.—And your opinion is that the field rivets that were driven, would compare very favourably in efficiency with a shop rivet?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—That they would give just as good service?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Now, we have covered that ground pretty thoroughly, so far; will you go on now, and tell us of any other points to which your attention was attracted?

Mr. KINLOCH.—There was an angle on a centre post section.

Mr. HOLGATE.—Which section of the centre post?

Mr. KINLOCH.—C.P. 6 R. A chain had got foul of it or something in the yard, and they cracked it, and Mr. Clark called us up and we went over and looked at it, and drawings were made and sent to Mr. Cooper at Phœnixville.

Mr. HOLGATE.—By whom?

Mr. KINLOCH.—I am not sure whether Mr. McLure or Mr. Birks made the drawing.

Mr. HOLGATE.—Sent to Mr. Cooper?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—By whom?

Mr. KINLOCH.—Well, it was approved by Mr. Cooper. I won't say; that is all I know; all these things were submitted to him. That is not my own personal knowledge, anyway.

Prof. GALBRAITH.—You mean the repair was submitted to him for approval?

Mr. KINLOCH.—Yes, that was repaired, anyway.

Mr. HOLGATE.—In accordance with the plan approved by Mr. Cooper?

Mr. KINLOCH.—Well, I have no personal knowledge that Mr. Cooper did approve that, but he approved most of these things, and I suppose he did this. I corrected myself on that.

Mr. HOLGATE.—Did you see a plan showing the repairs required?

Mr. KINLOCH.—I certainly must have, but I do not recollect now much about it.

Mr. HOLGATE.—Just describe what was repaired?

Mr. KINLOCH.—Well, it was simply a little piece broken out of the edge of an angle, a big heavy angle, one of the webs of the main centre post.

Mr. HOLGATE.—How high above the pier would that be?

Mr. KINLOCH.—About 50 feet, between 30 and 50 feet from the top of the pier. It was repaired by putting a plate of the same size or a little larger plate riveting it up on the angle, about 7 or 8 feet on each side of it. That was done a long time ago. I do not recollect much about it. I know it passed out of my mind.

Mr. HOLGATE.—You inspected that repair?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Was it properly done?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—You mentioned a repair that was made on chord A-9 L. Have you inspected that chord in connection with the part that was repaired, since the accident?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—And how did you find it?

Mr. KINLOCH.—All right.

Mr. HOLGATE.—Injured in any degree?

Mr. KINLOCH.—No, sir, practically the same as the day it was put on there.

Prof. GALBRAITH.—That is, the repairs are the same.

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Then with regard to the repairs made on the centre post, have you been able to examine that part since?

Mr. KINLOCH.—I think that is in the crushed part of the post.

Mr. HOLGATE.—So far you have not been able to locate that?

Mr. KINLOCH.—No, I have not.

Mr. HOLGATE.—Are there any other matters, Mr. Kinloch?

Mr. KINLOCH.—The top of the C.P., one section of the centre post, which has a bracket riveted on to it, when we riveted the other bracket on to it, we found it was dished slightly. That was reported to Mr. Cooper, and his recommendations were followed on it.

Prof. KERRY.—That is that one bracket was shop riveted to the post section.

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And the second bracket was field riveted?

Mr. KINLOCH.—Field riveted.

Prof. KERRY.—And it was found that the surface was dished and not perfectly plane.

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Mr. Cooper's recommendation was followed?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—What was it?

Mr. KINLOCH.—To secure a certain amount of bearing, I forget just what it was but Mr. McLure has it in his notes.

Prof. KERRY.—Which section, C. P. 1?

Mr. KINLOCH.—Both C. P. 1 R and C. P. 1 L.

Mr. HOLGATE.—Anything else?

Mr KINLOCH.—There was a slight error in detail in one of the top longitudinal struts. That was cut off. That was reported, I believe, to Mr. Cooper also. It was simply cut off, there was a plate put in there that interfered with the top of the post section in working. I believe that is about the only error in detail that we found in the whole bridge.

Mr. HOLGATE.—Do you mean to say that in the erection of that bridge, you found only that one error in detail?

Mr. KINLOCH.—That was the worst one that we found. There might have been some little things where maybe we would have to chip off a little of a plate or something like that, but simply more an error of the shop in workmanship of $\frac{1}{8}$ of an inch

or something. I do not remember any example of that but this plate, the top longitudinal level was the only correction we had to make, I do not remember any other at present?

Prof. GALBRAITH.—How many sections are there in the centre post?

Mr KINLOCH.—There is the peak that goes on top of the centre post, there are the caps which are the top section and C. P. 1, C. P. 2, C. P. 3 and 4 in one section, C. P. 5, C. P. 6 and the centre post foot.

Prof. GALBRAITH.—Then the only shop riveting that was done in these six sections was the junction at the splice between C. P. 3 and C. P. 4; is that what you mean?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—All the others were field riveted?

Mr. KINLOCH.—Field riveted, yes.

Mr. HOLGATE.—Then you found the work as delivered for erection, entirely accurate with the exception of that one instance that you mentioned?

Mr. KINLOCH.—In regard to detail, yes. These other holes, and one thing and another, those little inaccuracies, a blind hole, once in a while——

Mr. HOLGATE—And are those such as apply to any work?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Whether great or small?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—You refer now not only to riveted members but to all members in that whole structure?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Including eye-bars?

Mr. KINLOCH.—Eye-bars.

Mr. HOLGATE.—Pins and all other parts?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Were there any matters in connection with the pins or eye-bars that were discovered indicating inaccuracy or anything out of place at any time?

Mr. KINLOCH.—Would you repeat that?

Mr. HOLGATE.—During erection and after the eye-bar system had been placed, was your attention called to anything particular at any pin joint in the tension system which you examined?

Mr. KINLOCH.—Yes, sir. A set of diagonal bars showed a mark that I did not understand. I spoke to Mr. Yenser about it, and he sent a couple of men back and we broke all the key wrenches we had on the job trying to get a nut off, but could not and we examined it as well as we could without getting the nut off.

Prof GALBRAITH.—What one of the diagonals was that?

Mr. KINLOCH.—T. 40.

Prof. GALBRAITH.—Upper or lower?

Mr. KINLOCH.—On the lower side.

Mr. HOLGATE.—What was that unusual happened there ?

Mr. KINLOCH.—I assumed that a saucer had slipped a little bit?

Mr. HOLGATE.—This was on the left side?

Mr. KINLOCH.—Yes, sir. A saucer had slipped a little bit and made a mark there, and I did not know what had caused it and wanted to find out. We worked on it, as I said there. Mr. McLure and Mr. Milliken and Mr. Yenser and Mr. Birks were there, and we examined it and made up our minds that there was nothing in it because Mr. McLure had said that the bars had their maximum stress some time before, that the stress was getting less now than before and we waited until we could get a big key wrench and see what it was; we decided that it was one of two things, that two little rings in there had been left out or that there must have been some motion in there. Yesterday we succeeded in getting the nut out and saw there was no motion and as far as we can see the two little rings are missing, had not been packed in. They are more for looks than anything else.

Mr. KINLOCH.—Did you find the condition, on examination yesterday, to be what it should be?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—And nothing at all out of place?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Or wrong?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—With the exception of the little packing rings?

Mr. KINLOCH.—The packing rings were missing as far as we could see.

Mr. HOLGATE.—At any rate, the joint itself was intact and you had to remove the nut?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—I would like to cover all these points, Mr. Kinloch, if you can recollect them.

Prof. KERRY.—On that tension system in your inspections, Mr. Kinloch, did you notice anything that would indicate that the eye-bars were not acting equally, the eye-bars in any set, or had you reason to believe they were all equally strained, as far as you could judge?

Mr. KINLOCH.—As far as I could judge they all seemed to be about the same. There was one panel, the top chord eye-bars in the cantilever arm, that were not much strained yet, moving them with the feet some of them seemed to be tighter than the others; they were not strained up.

Prof. KERRY.—But all the panels that were fully strained seemed to be tightened up?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Now we would like you to go back and finish your own story of what you saw on the bridge without bothering with our questions yet, just your own recollections?

Mr. KINLOCH.—Mr. M'cLure called my attention to some plates at the foot of the centre post. That photograph shows that very well—(Exhibit 29)—where this diagonal connects to this post. The hitch angles between 50 and the centre post. (Witness indicated on the photograph the points referred to.) He called my attention to the paint crinkling on the outside of the plate like there might be a motion there of the P—50 and the centre post closing together. We examined all the rest of the same plates, there are eight of them altogether, and we found the same conditions to exist in all the eight plates.

Prof. GALBRAITH.—Were they bulging out?

Mr. KINLOCH.—They were not bulging out any more than the cracks in the paint were radiating just like the sun.

Prof. GALBRAITH.—Did the crack show in the paint or were there little bulges?

Mr. KINLOCH.—Just little bulges; the paint was raised up.

Prof. GALBRAITH.—The paint itself was bulged along this line?

Mr. KINLOCH.—Yes.

Prof. GALBRAITH.—Showing compression, showing coming together.

Mr. KINLOCH.—That is what it would indicate.

Mr. HOLGATE.—Was it a blistering of the paint?

Mr. KINLOCH.—I do not think so.

Mr. HOLGATE.—What did you do then, Mr. Kinloch?

Mr. KINLOCH.—I think that Mr. McLure took that up with Mr. Cooper, and he will have a record of that; he can explain it better than I can.

Mr. HOLGATE.—When you say there are eight of those plates, are you counting in the two centre posts?

Mr. KINLOCH.—Yes, in the two centre posts.

Mr. HOLGATE.—Four on each centre post?

Mr. KINLOCH.—Four in each centre post, yes. I do not know that I can think of anything more now until coming right down close to the time of the accident.

Prof. GALBRAITH.—At what period during the erection did you notice this, how far had the work been carried on the cantilever side?

Mr. KINLOCH.—The cantilever arm was erected.

Prof. GALBRAITH.—It was completed?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—Was any of the suspension bridge done?

Mr. KINLOCH.—I do not think there was. I do not think they had started to raise the suspension span.

Mr. HOLGATE.—Have you now enumerated all these matters which you might call extraordinary?

Mr. KINLOCH.—All that I can remember just now. There was that crack in that plate in P-4, that P-4 that Mr. Chase spoke of, that was repaired.

Mr. HOLGATE.—You refer now to the one that was mentioned by Lafrance?

Mr. KINLOCH.—No, by Chase.

Prof. KERRY.—You might give those particulars?

Mr. KINLOCH.—Shortly after the plate was put on——

Prof. KERRY.—Which plate?

Mr. KINLOCH.—This is a bent plate, I do not remember the number. It connects the lateral plate and the truss floor beam gussets to the post.

Prof. KERRY.—Which post?

Mr. KINLOCH.—P-4.

Prof. KERRY.—L or R?

Mr. KINLOCH.—R. There was a crack about 2 inches, I will say 2 inches limit in length opened up in the back edge of it, right close to the post. Whether it had been there before in the plate and that it had been fully opened when the bolts were put in I do not know, that is the first time I noticed it. It was repaired by putting another plate on top of it.

Prof. KERRY.—Were plans for that prepared and submitted to Mr. Cooper?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—It was just done right there?

Mr. KINLOCH.—Yes, it was considered of no importance, we did it right there.

Prof. KERRY.—Did you ever notice anything on the plates that have been mentioned by the witnesses Lafrance and Davis?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—You have also heard of the evidence of the witness Ouimet at the coroner's inquest?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Did you ever notice anything on that plate?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—And you had examined each of one those plates at frequent intervals?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And no report of any crack in those plates had reached you?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—The witnesses have stated that they saw the crack somewhere about the first of June. Roughly speaking, how many times would you have seen the plate since then?

Mr. KINLOCH.—Probably 150.

Mr. DAVIDSON.—I recollect that there was a point in Mr. Kinloch's evidence, when he was told that he would have a full opportunity of explaining some statements later. I would like to find out now what they were and what he has to say about them.

Mr. HOLGATE.—This is what Mr. Kinloch said:

'There is a line to draw. There were some things I wanted done that I did not

get done, but they were taken up and they never have been settled yet. It was out of the line of workmanship though.'

Do you recollect that statement of yours ?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—You may explain just what you meant there.

Mr. KINLOCH.—That was in regard to those paint holes in the chords.

Mr. HOLGATE.—That you have already referred to in this morning's evidence ?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Anything else ?

Mr. KINLOCH.—No, I cannot think of anything else.

Mr. HOLGATE.—When that matter was brought up in your previous evidence we said that we would bring it up again and give you a full chance to explain what you meant. Have you any further explanations to make?

Mr. KINLOCH.—Would you read that question again ?

Mr. HOLGATE.—The question that brought this up was this :

'Prof. KERRY.—During the work everything that you considered necessary as to the quality of the work or of the workmanship was done on your request.

'Mr. KINLOCH.—There is a line to draw. There were some things I wanted done that I did not get done, but they were taken up and they never have been settled yet. It was out of the line of workmanship though.'

Mr. KINLOCH.—I think that covers everything only little minor things like wanting to get some painting done or something like that ; nothing of any importance at all outside of the paint holes in the chord.

Mr. HOLGATE.—But nothing that affected the structure itself ?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Is that it, Mr. Davidson ?

Mr. DAVIDSON.—Well, of course Mr. Kinloch says these were the matters referred to. I did not know what they were, I just had what you have just read.

Mr. HOLGATE.—Mr. Kinloch says those are the only matters he has in mind. Is there any other point?

Mr. DAVIDSON.—Not in this particular part of the examination, no.

The Commission took recess.

AFTERNOON SESSION—ELEVENTH DAY.

Mr. HOLGATE.—Mr. Kinloch, did you make any minute examination of any particular parts of the structure immediately prior to the accident?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—You might tell us just what they were, beginning with the first calling of your immediate attention to it, and giving the dates consecutively through the whole examination.

Mr. KINLOCH.—Well, in regard to the date of my first noticing a buckling in the field splice of the east centre rib, in chord 7 and 8, I am not sure within about a week.

Mr. HOLGATE.—Chord 7 and 8, where ?

Mr. KINLOCH.—Cantilever arm.

Mr. HOLGATE.—Right or left?

Mr. KINLOCH.—Left.

Prof. KERRY.—Montreal side?

Mr. KINLOCH.—Montreal side, yes. But on going down to inspect that point after the rivets were driven, I first noticed this bent, it was bent in towards the other centre rib, as near as I can remember now, about half an inch and about 6 feet. Mr.

Birks and Mr. McLure had their attention called to it and they measured it, and I think Mr. McLure has a record of it.

Prof. KERRY.—Roughly about what time?

Mr. KINLOCH.—Oh, about four or five weeks before the accident. We talked together on some method of overcoming it, and it was finally decided to put a diaphragm up in there and by cutting out five rivets on each side of the joint, bring it back to its proper position. It was sent in to Mr. Cooper for his approval and he did not give it his approval. He evidently misunderstood the case, and there was nothing more done with it, it remained in that position up to the time of the accident.

Prof. KERRY.—That is the field splice between 7 and 8 on the cantilever arm, Montreall side?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—The buckle was in the east centre rib?

Mr. KINLOCH.—The centre rib.

Prof KERRY.—Towards the west centre rib?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And the two ends bent like that (indicating)?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—There would be no opening, Mr. Kinloch, between the cover plate and the rib, the plate itself would be bent?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—That is the whole story in regard to that point?

Mr. KINLOCH.—Yes. Now, as near as I can judge, about the 20th of August—I am not sure about that date either, it might be a day or two either way—the chord 8 and 9, cantilever arm, when a boy painted the rivets, I was coming down the chord and the new paint on the rivets drew my attention to it, and I fancied I could see a curve right at the splice. I investigated the same, and found that there was. I looked along the rest of the chord and found some distortion in that, in the ribs, that is chord 8.

Prof. GALBRAITH.—On which side of the panel point is the field splice?

Mr. KINLOCH.—It is to the river side of the post.

Mr. HOLGATE.—Did you observe closely what that bend amounted to?

Mr. KINLOCH.—Yes, sir, I looked at it very closely, I examined it with care, and chord 9 also, and found that somewhat distorted and also chord 10, in the cantilever arm, three chords, one on top of the other; but they were very slight, and I was very much in doubt in my mind whether they might have been something originally there, although they looked bigger to me than any I had seen before. But this one bend in the splice puzzled me a good deal.

Mr. HOLGATE.—That is in the splice between 8 and 9?

Mr. KINLOCH.—Yes, between 8 and 9.

Prof. GALBRAITH.—What plates showed that?

Mr. KINLOCH.—The side splice plates.

Prof. GALBRAITH.—On both sides?

Mr. KINLOCH.—Yes, sir. From the general appearance, to describe it, it would look just as if No. 9 chord was a little bit wider than No. 8. The bend did not seem to be in No. 9, but No. 9 appeared to run out straight and No. 8 to run out to meet it. This bend was very slight, but it was there,

Prof. KERRY.—That is to say both sides went out from the centre——

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.——of chord No. 8?

Mr. KINLOCH.—Of chord No. 8.

Mr. HOLGATE.—In what condition was that joint at that time?

Mr. KINLOCH.—Fully riveted. That is one thing that worried me as much as anything else, because I was positive when it was riveted up that it was straight.

Mr. HOLGATE.—Did you make any measurement to verify what appeared to the eye?

Mr. KINLOCH—No, I made no measurement of that.

Mr. HOLGATE.—When you discovered that, what did you do?

Mr. KINLOCH.—I called Mr. Birks' attention to it, and we talked the thing over there and he did not consider it much, in fact I did not consider it myself.

Mr. HOLGATE.—You talked it over where?

Mr. KINLOCH.—On the chord. Mr. McLure was in the hospital at that time. When Mr. McLure got out I called his attention to it. That was a couple of days afterwards.

Mr. HOLGATE.—What sort of an examination did Mr. Birks make at the time?

Mr. KINLOCH.—Just about like I did. We just got down and sighted along the ribs.

Prof. GALBRAITH.—Did the angles——?

Mr. KINLOCH.—The angles seemed to be straighter than the rest of it. It was more bowed at the centre than at the two ends.

Prof. GALBRAITH.—You had to stoop down and look over the side?

Mr KINLOCH.—We could stand on the ladder on the top and see it more plainly than anywhere else. We could see it more plainly on account of the new paint on it.

Prof. KERRY.—Do you know if that was reported to Mr. Cooper?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Do you know if it was reported to Mr. Hoare?

Mr. KINLOCH.—No, I do not.

Prof. KERRY.—Do you know if it was reported to Mr. Yenser?

Mr. KINLOCH.—Yes, it was reported to Mr. Yenser.

Prof. KERRY.—Did he express any opinion at all?

Mr. KINLOCH.—No. At that time we all considered it unimportant although it was pretty hard to figure out what you would consider it now and then. I am trying to separate this thing and get out what I thought at that time.

Prof. KERRY.—It was a very unusual thing, almost otherwise unknown, for the outer cover plate to show any alteration from the flat?

Mr. KINLOCH.—Yes, sir. I do not know of any other place in the bridge whichever did that, except in chord 9-L in the anchor arm afterwards.

Prof. KERRY.—There might have been such distortions on the inner ribs without their being observable?

Mr. KINLOCH.—Yes.

Prof. KERRY.—They would be covered up?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Is that the only thing noticeable in that chord?

Mr. KINLOCH.—The ribs were bent and the chord.

Mr. HOLGATE.—Just at that place?

Mr. KINLOCH.—No, they were irregular bends. They were not long bends like other chords. They were more like any bends would be in any chord. They were not uniform; they were not all bent in any one way.

Prof. GALBRAITH.—In designating the chords the numbers refer to the distance from field splice to field splice and not to the distance from panel point to panel point?

Mr. KINLOCH.—No, sir, from field splice to field splice.

Prof. GALBRAITH.—So that the same chord is in different panels?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—The bends that you refer to, Mr. Kinloch, did you consider at that time that they were shop bends?

Mr. KINLOCH.—I was in doubt about it. They were not pronounced enough more than the others to enable me to determine whether they could have been made in the field or whether they were shop bends.

Mr. HOLGATE.—But you did not observe them before August 20?

Mr. KINLOCH.—No, sir; about that date. It was within a day or two of the 20th.

Prof. GALBRAITH.—How long had that chord been in position ?

Mr. KINLOCH.—Since away early in 1906. Mr. McLure could give you the exact date.

Mr. HOLGATE.—When you met Mr. Birks there did he lead you to suppose that he had noticed that before?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Can you say that it had been noticed by any one before that time ?

Mr. KINLOCH.—No, not at that time; not the first time.

Mr. HOLGATE.—Not before the 20th of August ?

Mr. KINLOCH.—No.

Prof. KERRY.—I understand, Mr. Kinloch, that it has not been unusual to find that the centre ribs of 2 adjoining chord sections did not line correctly when the lower cover plate was taken off ?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Was that ever noticed on the outside ribs ?

Mr. KINLOCH.—Not to my knowledge.

Prof. KERRY.—Only on the centre ribs ?

Mr. KINLOCH.—Only on the centre ribs?

Prof. KERRY.—And it was the practice in that case to jack the centre ribs over from the outside ribs until they came into perfect line when they were rivetted ?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—So that that failure to line correctly on the part of the centre ribs might be attributed either to the working of the bridge or to the failure to draw these two ribs into exact line at the time that chord was originally put in? You had no means, in other words, of knowing that the two inside ribs lined exactly at the time it was put in place ?

Mr. KINLOCH.—Not at the bottom, no, sir.

Prof. GALBRAITH.—What was the practice with respect to the placing of the diaphragm plates ? Was it the practice to place the diaphragm plates close to the ends of the ribs in all cases ?

Mr. KINLOCH.—Some were right at the ends, but most of them were back about three or four feet.

Prof. GALBRAITH.—From the cover plate ?

Mr. KINLOCH.—No, they were not on the other side of the cover plate but back from the joint about three or four feet as near as I can remember.

Prof. GALBRAITH.—Do you remember many cases where they were within six inches or a foot from the end of the ribs ?

Mr. KINLOCH.—No; on chord 10 they were at the end of the joint and at the end of No. 9, I think; I am not positive now without looking at the drawings.

Prof. GALBRAITH.—On chord 10 they were close to the joint?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Going back to the side plates, Mr. Kinloch, it was the practice, was it not, in making provision for the camber to have the lower chord joints alternately open at the top and bottom ?

Mr. KINLOCH.—Yes.

Prof. KERRY.—Was there any noticeable difference in the lining of the ribs of the chords at the joints that were differently treated in that respect?

Mr. KINLOCH.—Yes, sir, in pretty nearly all the cases—the ones that I know of—they were all right at the top. It was only at the bottom that the ribs were off line.

Prof KERRY.—Supposing you took one case in which two chord sections were brought together at the top with a camber opening down at the bottom and then took another case in which two chord sections were brought together at the bottom and the camber opening at the top, would be there be any noticeable difference in the accuracy with which these two would line when you got ready to rivet up?

Mr. KINLOCH.—I think I answered that question. The ones that were open at the bottom would not line. The only ones that do not line are there.

Prof. KERRY.—When they were open at the top they lined all right?

Mr. KINLOCH.—Yes.

Prof. KERRY.—The ones that were open at the bottom did not line well? What was the power of the jacks that was needed to force these—the ordinary screw jacks?

Mr. KINLOCH.—It took different power at different places. It depended on when they were jacked and where they were jacked. We usually used a 25-ton Norton jack.

Prof. KERRY.—Was it hard jacking them?

Mr. KINLOCH.—Yes, pretty hard to jack them.

Prof. KERRY.—It varied, I suppose?

Mr. KINLOCH.—Yes, it varied at different points.

Prof. KERRY.—Did you ever have to use more than one jack?

Mr. KINLOCH.—We always had to use two—one to hold each rib.

Mr. HOLGATE.—In this succession what was the next matter that came to your attention?

Mr. KINLOCH.—The same chord again—No. 8 chord. I went down next day or the day after that, and I imagined it was getting worse.

Mr. HOLGATE.—That was the 21st or the 22nd of August?

Mr. KINLOCH.—It was a couple of days after or the next after—I do not remember which. One of the Indians was there and I asked him if he noticed anything about it and he said it did not look to him like it was bent like that before. I asked him if he had noted anything peculiar, and he said no. I asked him if he was sure it had not been bent before and he said no.

Prof. GALBRAITH.—Are you now speaking of the bend in the side plates?

Mr. KINLOCH.—In chord 8—not in the side plates but in the body of the chord itself.

Prof. GALBRAITH.—Along the ribs?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—The point that you now speak of is one that you had seen before but which seemed to have increased?

Mr. KINLOCH.—Yes, sir; it looked that way to me.

Prof. KERRY.—What was the Indian's name?

Mr. KINLOCH.—I cannot remember about it, whether it was Morris or Elm.

Prof. KERRY.—Were they in the accident?

Mr. KINLOCH.—Morris was killed and Elm is alive yet. I did not know them apart very well.

Mr. HOLGATE.—What appearance did it have on this second inspection?

Mr. KINLOCH.—Just about the same, only I thought I was nervous and was seeing more than really was there.

Mr. HOLGATE.—Did the bend confine itself to any particular rib or did it cover the whole chord?

Mr. KINLOCH.—All four ribs were bent, but they were not bent alike.

Mr. HOLGATE.—In which direction were they bent?

Mr. KINLOCH.—Three of them at the top were bent towards Montreal, and down part way they were bent towards Quebec, and the inside rib was bent towards Montreal, but very slight.

Prof. KERRY.—That is the rib on the Montreal side of the Quebec chord?

Mr. KINLOCH.—Yes, sir.

Mr HOLGATE.—Do I understand that description to mean that it would bring a wind on the chord?

Mr. KINLOCH.—No, the bend crossed. It would be the shape of a long letter S or a question mark.

Mr. HOLGATE.—That would mean then that the space between the ribs on the Montreal side of the chord would be increased at the bend?

Mr. KINLOCH.—Increased at the bottom or decreased at the top, or about the same at the top.

Mr. HOLGATE.—Then, was there anything observable in the lacing?

Mr. KINLOCH.—No, sir, I did not notice anything, but I did not look particularly, any more than there was not enough to notice just looking off-hand. I did not sight over the lacing; I just walked over it and looked at it.

Mr. HOLGATE.—You did not make any test whatever?

Mr. KINLOCH.—No, sir.

Prof. GALBRAITH.—What do you mean by towards the top and towards the bottom in that answer?

Mr. KINLOCH.—In the bottom, I call that the field splice between 8 and 9, and the top would be the field splice at 7 and 8.

Prof. GALBRAITH.—In other words, you call the higher end of the chord the top and the lower end the bottom?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—That brings us up to the 21st or 22nd of August. Now, then, continue on further?

Mr. KINLOCH.—Well, I kept very close watch on these chords to see if there was any further movement in them.

Mr. HOLGATE.—You are referring to——?

Mr. KINLOCH.—Chords 8, 9 and 10 in the cantilever arm, particularly 8 and 9. I did not pay much attention to 10—on the Quebec side. I was not seriously alarmed about them, but I kept my eye on them to see what they were doing if there was anything.

Mr. HOLGATE.—Did you frequently see them afterwards?

Mr. KINLOCH.—Three or four times a day.

Prof. KERRY.—Are they to any extent visible at low tide now?

Mr. KINLOCH.—No. 9.

Prof. KERRY.—No. 8 is not?

Mr. KINLOCH.—No.

Prof. KERRY.—No. 10?

Mr. KINLOCH.—No. 10 is visible but it is destroyed; you cannot tell anything about it.

Prof. GALBRAITH.—What do you mean by saying that it is destroyed?

Mr. KINLOCH.—It is all flattened down. It is on top of the pier and it is lying on its side and the members are lying one on top of the other. You cannot see anything at all only that it is just there.

Prof. GALBRAITH.—And No. 9?

Mr. KINLOCH.—No. 9—you can see about half of it at low tide.

Prof. GALBRAITH.—It is in bad shape, is it not?

Mr. KINLOCH.—It does not look bad.

Mr. HOLGATE.—On these several inspections were you accompanied by anybody?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Did anybody else go down after the 22nd?

Mr. KINLOCH.—I have no personal knowledge, but I think Mr. Birks went there.

Mr. HOLGATE.—Did you notice any change yourself in any of them?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—Yes?

Mr. KINLOCH.—That was Tuesday before the accident.

Mr. HOLGATE.—What date was that?

Mr. KINLOCH.—The 27th. I discovered this bend in chord A-9-L anchor arm.

Mr. HOLGATE.—What time of the day was that?

Mr. KINLOCH.—About 9 o'clock.

Mr. HOLGATE.—When previously had you been on that chord?

Mr. KINLOCH.—Saturday is about the last time I can remember being there.

Mr. HOLGATE.—The previous Saturday?

Mr. KINLOCH.—Yes.

Mr. HOLGATE.—But it was not until Tuesday that you noticed it?

Mr. KINLOCH.—No, sir. As I turned around the post——

Mr. DAVIDSON.—I would like you to ask Mr. Kinloch, if, on the Saturday previous, he examined it sufficiently to see whether there was any bend in it?

Mr. HOLGATE.—Are you in a position to say that there was any bend in the chord on the Saturday?

Mr. KINLOCH.—I did not notice any. Mr. Yenser and Mr. Birks were down at the foot of lower 10 chord and as soon as I saw it I called them up there. It was apparently, to me, quite alarming. It was a big bend and I was satisfied right off that there was something going on.

Prof. GALBRAITH.—That is on the same side of the bridge?

Mr. KINLOCH.—9-L anchor arm.

Prof. GALBRAITH.—Where were Birks and Yenser?

Mr. KINLOCH.—Down below—right below at the chord and the shoe—10-L. They came up and looked at it. I guess we put in 25 or 30 minutes looking it all over. Mr. Yenser said when he came there: That has never been there before; I have been over this chord too many times. He started in to talk; he would not put up any more iron till he found out about it. Birks kind of laughed at him and said that he had better wait until he found out, that when he was condemning that chord he was condemning the whole bridge, and he said it might have been in there before. He said he better wait until he investigated it. Mr. Birks and I went up to the office and I went in and told Mr. McLure and we immediately went down and measured it—went right up and down, took measurements of the bend and examined everything—lacing and rivets—and looked the chord all over. At this time there was none of us noticed any bend in the field splice.

Prof. GALBRAITH.—Between——?

Mr. KINLOCH.—Between 8 and 9. There was considerable talk as to what they would do by Birks, Yenser, myself and McLure, as to how serious it was, as to what the stress on the chord was, and one thing and another; Mr. McLure can probably give these figures better than I can, but it was finally decided that they would not move out the traveller until they got some word. I do not know who decided it, but that was the general supposition when we got through. We also went over and measured 8 and 9 chords on the cantilever arm and talked about them. We passed No. 10 up; we did not measure it because it was not near as bad as the one on the anchor arm and the other two in the cantilever arm. Mr. McLure called up Mr. Hoare and he came out in the—no, he went in that night and Mr. Hoare came out next day.

Mr. HOLGATE.—Mr. McLure went in that night to Quebec?

Mr. KINLOCH.—Yes, he went in to see Mr. Hoare that night and he called him up that afternoon on the telephone, I think. He can tell you better himself than I can.

Prof. KERRY.—Did you make any examination of No. 9 chord in the anchor arm on the Quebec side at that time?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And it was all right?

Mr. KINLOCH.—Yes.

Prof. KERRY.—No visible defects?

Mr. KINLOCH.—No visible defects. We also at the same time that afternoon and next morning examined thoroughly all the compression members and all the tension members; in fact, we gave the bridge a thorough inspection all over. That was on Mr. Hoare's orders. First we went at it ourselves and then Mr. Hoare called me up and told me to make a thorough examination of everything all over, which I did—I on the bottom, and Mr. McLure on the top.

Prof. KERRY.—You had just found three members which showed marked peculiarity?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—9-L in the anchor arm and 8-R and 9-R in the cantilever arm?

Mr. KINLOCH.—Yes, sir. Wednesday morning when we came out I was out at the front about fifteen minutes after seven and I saw that they were loosening the traveller to run it ahead. I talked to the assistant foreman and told him that they

were not going to move the traveller, and he said that he had orders to do it. I asked him who gave him the orders and he said Mr. Yenser. I started back to hunt up Mr. Yenser and I met Mr. McLure on the approach span and I asked him if he knew that they were moving the traveller and he said yes. I said: How about it? And he said: I do not know, only Ben said that he had a dream last night. I said: That is kind of funny. He said: Ben says he has got too many men out.

Prof. GALBRAITH.—On the work?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—What did he mean by that?

Mr. KINLOCH.—I suppose that he meant that he had too many men to work on the traveller and could not work them unless he was raising steel, but I did not see Mr. Yenser to talk to him that day about moving out the traveller. But the traveller was moved out.

Mr. HOLGATE.—You are referring now to the smaller traveller?

Mr. KINLOCH.—Yes, sir. On Wednesday I went over all these chords several times and I did not notice any change. There was no iron added Wednesday at all; there was more taken off than put on on account of moving the traveller. They were taking stuff off all the time. Thursday they put in temporary track stringers. I guess they had them finished up about eleven o'clock and about noon or right after dinner two sections of the bottom chord of the suspended span were run out.

Prof. GALBRAITH.—No. 4 panel?

Mr. KINLOCH.—Yes, sir—and hooked on to and slacked over into place to be joined. Just about 15 or 20 minutes before the accident they had this chord straight and in position to put in the bolts. They had a few bolts in on each side.

Prof. KERRY.—That is at the joint between the 3rd and 4th panels?

Mr. KINLOCH.—Yes, the 4th panel field splice. There was one chord of diagonal bars with their attachments ready to be erected on the temporary track stringers when I left there. I came in on the approach span and the others for the upstream side were on the car there. I marked them with their spacing and I should judge that they had just about time to get to the end when the accident happened.

Prof. KERRY.—They were being pushed out by the locomotive?

Mr. KINLOCH.—Yes. The locomotive had one car between it and the bars. They came by—there was a small gang on the second panel of the anchor arm letting down the erecting material from the big traveller. They had one small piece on there and the engine was away to get that car on the track to come in and make the switch. They had to come in and get the other car and push it out ahead of them.

Prof. KERRY.—Can you tell us about your inspection of Wednesday? To the best of your knowledge, who inspected these chord sections on Wednesday, at what time and what was the observation and discussion?

Mr. KINLOCH.—I think I inspected them about three times in the morning and three times in the afternoon. I know I met Mr. Birks twice when I was on my trip doing the same thing.

Prof. GALBRAITH.—Your main attention was given to the lower chords?

Mr. KINLOCH.—Yes, sir; practically the whole of it, but we were watching all these joints. On Wednesday Mr. Birks came to me and said: 'I think I have discovered where we have made big fools out of ourselves, or at least, I think I have anyway; I see what is the matter now. He said: That bend runs up to the field splice. I said: Do you know when that was riveted? I said: I can tell within a day or two.

Prof. GALBRAITH.—Are you speaking now of A-9-L?

Mr. KINLOCH.—A-9-L.

Prof. KERRY.—That would be the 8 and 9 field splice?

Mr. KINLOCH.—Yes, so, of course, I went down to look at the chord and I also hunted up the records. I found that the chord did show a bend running up, but not as much to the field splice. This No. 8 chord seemed to be straight, but No. 9 chord

curved into it some way, but the bend at the top was not as much as it was in the body of the chord. I did not measure it and I do not know whether Mr. Birks did or not.

Prof. KERRY.—That is to say, it would be as if the north end of No. 8 chord had got pushed towards Montreal a little bit.

Mr. KINLOCH.—No, it seemed to be straight.

Prof. KERRY.—As if the whole chord was straight the north end up a little towards Montreal, and the 9th chord had curved around in a circle to meet it.

Mr. KINLOCH.—No, it was not pushed towards Montreal. It did not appear to be. No. 8 chord appeared to be straight right to the splice and No. 9 chord seemed straight and then curved right at the splice.

Prof. KERRY.—The belly of the curve was in which direction?

Mr. KINLOCH.—In towards the centre of the truss.

Prof. KERRY.—Towards Quebec——?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—I understand you to mean this, that the bend in No. 9 extended from the foot of the member known as T-5-Z to the field splice between chords No. 9 and No. 8?

Mr. KINLOCH.—No, it extended from the cover plate south to T-5-Z.

Prof. GALBRAITH.—It extended from the cover plate to T-5-Z and the field splice between 9 and 8.

Mr. KINLOCH.—There was a very slight bend right at the cover plate, but there was practically none there.

Prof. KERRY.—Was the outside plate at the field splice between 8 and 9 bent?

Mr. KINLOCH.—Yes, it was deformed a little with a curve.

Prof. KERRY.—That is where the curve started?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Did you say anything more about it at that time, Mr. Kinloch?

Mr. KINLOCH.—More in a kind of joking way with Mr. Birks in talking.

Prof. KERRY.—Who last inspected these chords during the day?

Mr. KINLOCH.—I do not know of anybody but Mr. Birks and myself. Whether Mr. Yenser went over them or not I do not know.

Prof. KERRY.—You did not notice any increased deflection?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Did Mr. McLure go over them?

Mr. KINLOCH.—Mr. McLure was in New York. He left at noon.

Prof. KERRY.—Did Mr. Hoare?

Mr. KINLOCH.—Mr. Hoare was up and looked at them—yes, sir.

Prof. KERRY.—But he did not go over them?

Mr. KINLOCH.—No, I do not think he did. I did not see him.

Mr. HOLGATE.—Could you make any inspection of a thing like that from the track?

Mr. KINLOCH.—I could see it quite plainly from the track, or Mr. Birks or Mr. McLure.

Prof. KERRY.—The traveller started to move out?

Mr. KINLOCH.—Early Wednesday morning they started to take the attachments off. It takes a long time to move the traveller; in fact, it takes almost a day to move it and fasten it down.

Prof. KERRY.—There was no general consultation after the one you had on Tuesday mornnig?

Mr. KINLOCH.—I do not recollect any now that I was in.

Mr. HOLGATE.—You say that Mr. McLure was away?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Do you know for what purpose he had gone away?

Mr. KINLOCH.—Yes, sir. He went to explain the matter to Mr. Cooper and get his advice on it.

Mr. HOLGATE.—When was the last inspection made of these chords?

Mr. KINLOCH.—I should say about four o'clock.

Mr. HOLGATE.—On——?

Mr. KINLOCH.—Thursday, the 29th; that is the last close inspection.

Mr. HOLGATE.—By yourself?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Any others?

Mr. KINLOCH.—I do not know of any others.

Mr. HOLGATE.—What was observed then different from what you had observed before?

Mr. KINLOCH.—I did not notice anything any different.

Prof. KERRY.—Did you discuss the matter with Mr. Birks and Mr. Yenser at all on Thursday?

Mr. KINLOCH.—Yes, Thursday morning, when we started to run the stringers out. I was out on the front when they came out and put them in—down underneath—and when I came up and saw them I came back. I should judge that was about eleven o'clock, or 10.30, or something like that. Mr. Birks met me on the anchor arm, and he says: Well, it is all right; I have got word from Phœnixville that they have a record that these chords were bent before.

Prof. KERRY.—Did he mention the chords?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—What did you think he meant?

Mr. KINLOCH.—I thought he meant No. 9 chord.

Prof. GALBRAITH.—Both No. 9s were referred to?

Mr. KINLOCH.—No. 9 was the one that we were interested in and my mind centred on that one chord?

Prof. GALBRAITH.—A-9-L.

Mr. KINLOCH.—Yes.

Prof. GALBRAITH.—I think he spoke of chords in the plural?

Mr. KINLOCH.—He said chord. I laughed at him and told him that it was not, and he just went on. That is all that was said between us about it.

Mr. HOLGATE.—But when you inspected A-9-L, did you also inspect A-9-R?

Mr. KINLOCH.—Not so frequently as I had A-9-L.

Mr. HOLGATE.—I refer to the last time you inspected A-9-L.

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—When was the last inspection of A-9-R?

Mr. KINLOCH.—About eleven o'clock.

Mr. HOLGATE.—What day?

Mr. KINLOCH.—On the same day.

Mr. HOLGATE.—The 29th.

Mr. KINLOCH.—Yes, the day of the accident.

Mr. HOLGATE.—What did you find?

Mr. KINLOCH.—It seemed to be all right.

Mr. HOLGATE.—And the other chords that you mentioned?

Mr. KINLOCH.—They did not seem to be any worse at any time we measured them.

Prof. KERRY.—You have not said definitely, Mr. Kinloch, but are we to infer that in the discussions that took place your own opinion was that there was something serious the matter with the chords that you did not understand that required immediate attention?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—You did not depart from that position?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—We also understand that you reported the matter personally to Mr. McLure on Tuesday morning?

Mr. KINLOCH.—He went down and helped to measure it at the same time.

Prof. KERRY.—It was reported to Mr. Hoare on Tuesday night?

Mr. KINLOCH.—Tuesday afternoon.

Prof. KERRY.—And you went over the bridge with Mr. Hoare on Wednesday?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Did either of these gentlemen give you any instructions about it?

Mr. KINLOCH.—No, sir. Mr. Hoare gave me some instructions, or asked me if I had been over the rest of the bridge and told me to keep a close watch of the different members; asked me particularly about the lateral joints, and if I could see any deformation any place else.

Prof. GALBRAITH.—Did you observe anything wrong in the laterals—the sway braces or any cross connections?

Mr. KINLOCH.—No, sir. The cross strut at that point——

Prof. GALBRAITH.—That is at——?

Mr. KINLOCH.—At the foot of P-4 post—had a bend in it close to the east truss that had always been there, of about half an inch. It was a box girder, and it was bent in both webs.

Prof. GALBRAITH.—The cross piece is not the floor beam?

Mr. KINLOCH.—No, it acts as a truss.

Prof. KERRY.—The floor beams were all in place?

Mr. KINLOCH.—Yes, the floor beams were all in place.

Prof. GALBRAITH.—At which place?

Mr. KINLOCH.—At that place.

Prof. KERRY.—On the anchor arm?

Mr. KINLOCH.—On the anchor arm and cantilever arm.

Prof. KERRY.—Were in place and riveted?

Mr. KINLOCH.—Not all riveted on the cantilever arm.

Prof. KERRY.—But all riveted on the anchor arm?

Mr. KINLOCH.—Yes.

Prof. KERRY.—What was the condition of the stringer system of the anchor arm?

Mr. KINLOCH.—The stringer system was incomplete in three or four panels before the fixing of the tracks for erection purposes and they were using the stringers that belonged there at other places.

Prof. KERRY.—Which three or four panels particularly?

Mr. KINLOCH.—Panels 10 and 9 to 8—7 I do not know—I am not sure about that, but instead of the stringers being in their places, they used the electric railway stringers to carry the track and roadway. The stringers were doubled up and underneath there was a blocking on top of the floor beams to carry the erection track.

Prof. KERRY.—That would be wooden blocking?

Mr. KINLOCH.—Yes.

Prof. KERRY.—The stringers would rest on top of this wooden blocking?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—I should like to make sure about this strut between the feet of posts 4. What is the amount of the kink or bend there, close to the east truss that you mentioned?

Mr. KINLOCH.—It was a bend like that (indicating), it had been there all the time.

Prof. GALBRAITH.—Was it there before it had been put into the bridge?

Mr. KINLOCH.—Yes, evidently in the shop.

Prof. GALBRAITH.—In the shop, it was not due to stress?

Mr. KINLOCH.—No, sir.

Prof. GALBRAITH.—What was the extent lengthwise?

Mr. KINLOCH.—It came in about one lacing panel.

Mr. HOLGATE.—How far was that lacing panel from the chord?

Mr. KINLOCH.—Very close, I should say now just off-hand, 8 inches, 8 or 10 inches.

Mr. HOLGATE.—It was not a general bend in the whole member?

Mr. KINLOCH.—No, it was a short bend, it was all taken up in there, almost like an off-set.

Prof. GALBRAITH.—And it was a shop bend, you think?

Mr. KINLOCH.—Yes, I know it was a shop bend.

Prof. GALBRAITH.—How did that pass inspection? You cannot answer?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—And how would the deflection in chord 9-L pass inspection?

Mr. KINLOCH.—In chord 9-L?

Prof. KERRY.—Mr. Birks' statement was correct that the mill had a record of it, and that it was a shop deflection?

Mr. KINLOCH.—I do not see how it could.

Prof. KERRY.—In your final inspections, Mr. Kinloch, you were watching for all evidences of any movement among the different parts, of course, were you not?

Mr. KINLOCH.—Yes, sir, particularly those chords in the shoes.

Prof. KERRY.—Did you notice any change in the lacing anywhere?

Mr. KINLOCH.—No, sir. Except that lacing No. 9-L chord was strained awful high. Both times that we were down there, the time Mr. Yenser and Mr. Birks and myself were down there I tested the lacing with my hammer, and they sang as if they had an awfully good pull on them, and again when Mr. McLure and myself were down we examined those lacings very carefully, especially in chord A-9-L, and both top and bottom were examined, every rivet we looked to see if there was any bend or if it was cracked any place, if they were humped or sagged or bent in any direction, and we could not discover any evidence that they were distorted the least bit with the exception of one loose rivet.

Prof. KERRY.—Taking any one of the chords in that lacing, were both members strained or was one tight and the other loose?

Mr. KINLOCH.—My recollection is that they were all strained, they all sounded high.

Prof. KERRY.—Both arms of the 'X' and the straight cross piece as well?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And the riveting was all in good condition with the exception of this one loose rivet.

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Are you clear as to whether that rivet had always been loose or not?

Mr. KINLOCH.—No, sir, I know positively it was tight before.

Prof. KERRY.—How long before?

Mr. KINLOCH.—You mean how long was I sure it was tight before?

Prof. KERRY.—Yes.

Mr. KINLOCH.—I could not say that but I know it was tight that one time, because I have tried it several times.

Prof. KERRY.—You made an inspection of it?

Mr. KINLOCH.—The reason is there had always been a little short chain bend in it and I always watched it. I remember doing it two or three times, but would not say whether it was a month or two weeks before the accident.

Prof. GALBRAITH.—Which rivet was this?

Mr. KINLOCH.—The rivet in the west centre rib in that cross angle.

Mr. HOLGATE.—In the angle running at right angles to the chord?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—That was a shop rivet?

Mr. KINLOCH.—No, that was a field rivet, that angle had been cut off and put on again.

Mr. HOLGATE.—Can you locate the last rivet referred to?

Mr. KINLOCH.—It is the second tie angle down from the cover plate over splice 8 and 9, and it is in the west centre rib, the only one rivet there.

Prof. GALBRAITH.—What do you mean by the tie angle?

Mr. KINLOCH.—The cross angle.

Prof. GALBRAITH.—A straight one?

Mr. KINLOCH.—The straight one that crosses.

Prof. GALBRAITH.—It is in that piece and in the west centre rib.

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—You said that that rivet was a field rivet; how did that happen?

Mr. KINLOCH.—There were some angles that we cut off at the time it was repaired and replaced.

Prof. KERRY.—So far as you know, Mr. Kinloch, after the discussion as to the advisability of moving out the traveller, there was no definite action taken in the way of saying either that the traveller should be moved out or that the traveller must not be moved out by any officer of the Quebec Bridge Company.

Mr. KINLOCH.—No, sir, I do not know of any.

Prof. KERRY.—Do you know, Mr. Kinloch, what grounds Mr. Yenser had for deciding to move the traveller out on Wednesday morning, when it had been understood on Tuesday towards noon, that it would not be moved until he got specific orders?

Mr. KINLOCH.—No, sir, I do not.

Prof. KERRY.—So far as you know, no instructions concerning that chord reached Mr. Yenser in that time?

Mr. KINLOCH.—You mean from Phœnixville?

Prof. KERRY.—From any source?

Mr. KINLOCH.—I do not know.

Prof. KERRY.—Do you know if he got any information from anywhere.

Mr. KINLOCH.—I do not know a thing about it.

Prof. KERRY.—You had absolutely no communication with him, and know nothing of his reasons?

Mr. KINLOCH.—No, sir, I did not speak to him about it at all.

Prof. GALBRAITH.—Did you ever hear why he removed it before he received instructions?

Mr. KINLOCH.—No, sir.

Mr. STUART.—I understand that Mr. Birks had made some calculations as to the additional strain that would be put on the structure if it were moved, both Mr. McLure and Mr. Birks. I understand that was done and the results were communicated to Mr. Yenser?

Prof. KERRY.—Can you produce evidence of that?

Mr. STUART.—Mr. McLure will be able to give evidene of that.

Mr. KINLOCH.—Mr. McLure and Mr. Birks made some calculations, but I do not know whether that influenced him to move the traveller or not. They made calculations that it would only increase the stress in that No. 9 chord a certain per cent, but he was still of the opinion after the calculation was made that something was seriously wrong there.

Prof. KERRY.—You know that definitely?

Mr. KINLOCH.—Well, that was his talk.

Prof. KERRY.—You mean you heard the talk yourself?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—You heard him say so?

Mr. KINLOCH.—Yes, sir, we were talking together.

Prof. KERRY.—You also know, from what you have heard of the general conversation, that it was clear to everybody that the moving forward would increase the strain on the member?

Mr. KINLOCH.—Yes, sir, they have the figures for that, Mr. McLure.

Prof. GALBRAITH.—The engineer would probably make the calculations to determine the increase in stress for each time the traveller was moved out? Do you know whether that was the practice or not?

Mr. KINLOCH.—Well, Mr. McLure can tell you more about that.

Prof. KERRY.—Do you know to what extent the condition of the chords was a matter of general knowledge among the bridge men, and on what dates?

Mr. KINLOCH.—Well, I guess Wednesday after we had measured there was a general talk among a good portion of them, although some of them did not know it next morning, when they moved the traveller out. I spoke to Worley, and he did not know of it. That was Wednesday morning, and we measured Tuesday. I also spoke to his assistant foreman, I do not know what his name is, his nickname is 'Frenchman.' I had a number of men ask me about it as I was going around; they asked me and would say: How about that chord? But they all generally were referring to the chord in the cantilever arm.

Mr. STUART.—Worley's ignorance would be accounted for by the fact that he was not there on Tuesday, he was sick?

Prof. GALBRAITH.—Which of these chords do you think the men feared the most, or talked most about?

Mr. KINLOCH.—Most of the inquiries they made of me referred to the chords in the anchor arm.

Mr. HOLGATE.—Was this a matter of general conversation?

Mr. KINLOCH.—It would not be with me, but among the riveters——

Mr. HOLGATE.—Amongst the men?

Mr. KINLOCH.—I cannot say, as I was not mixed up with any gang, but I know a good many asked me about it, so I presume it must have been.

Prof. KERRY.—Did any officials of the Canadian government visit the bridge for inspection purposes?

Mr. KINLOCH.—There is a Mr. Johnston.

Prof. KERRY.—There is a Mr. Johnston, yes, connected with the government?

Mr. KINLOCH.—He has been out there I do not know how many times.

Prof. KERRY.—Officially?

Prof. KERRY.—I suppose he was official.

Mr. HOLGATE.—Alone?

Mr. KINLOCH.—No, I think Mr. Hoare was with him both times, if I am not mistaken, that I saw him.

Prof. KERRY.—That is to say, the visits were very rare?

Mr. KINLOCH.—I do not know; lots of times I would be on shore for half a day at a time. He might be there and go and I not know.

Prof. KERRY.—If a man was coming out to inspect the bridge and you were on the bridge you would probably see him, would you not?

Mr. KINLOCH.—I think I would, yes.

Prof. KERRY.—What I wanted to get at was whether there was any regular outside inspection system existing that you know of. There would be then no one with the exception of the inspectors of the Quebec Bridge Company and the officers of the Phœnix Bridge Company who would be in a position to know anything that was happening?

Mr. KINLOCH.—No, I do not think so.

Mr. HOLGATE.—When Mr. Johnston visited the bridge, what sort of an inspection did he make?

Mr. KINLOCH.—Well, sir, I do not think he made much of an inspection. He did not come out, he was down on the ground and did not come out to see; he could not climb on a span.

Mr. HOLGATE.—Did you ever accompany him through the structure?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Have you told us now of every defect that has come to your notice, Mr. Kinloch, to the best of your recollection?

Mr. KINLOCH.—I think I have; I do not think I can remember any more.

Mr. STUART.—Mr. Haley, in his evidence, is reported in this way: '(The witness indicated the splice marked No. 9 on the Quebec side of the cantilever arm of the

lower chord.)' Later on he said that it was bulging out on both sides. I would like to ask Mr. Kinloch what was the condition of that particular piece, whether it was bulging on both sides.

Mr. HOLGATE.—It has been stated, Mr. Kinloch, that the splice on the chord No. 9 on the Quebec side of the cantilever arm was found to be bulging out on both sides?

Mr. KINLOCH.—It is the same joint I described.

Mr. HOLGATE.—It is the joint between 8 and 9, and the witness says it was bulging. He was asked: 'What was bulging actually? What part of the splice?' And the witness said: 'All the webs and the chord. There were four webs in this chord, two outside ones and two centre ones; they were all giving way. The two outside ones were going out.'

Mr. STUART.—He also says that the inside web was bending. What I want to know is whether that is an accurate statement, whether the webs were bending in a different way, one towards Montreal, and one towards Quebec, which of course does not correspond with that?

Mr. KINLOCH.—It does to a considerable extent. The only difference I can see in Haley's and mine is that Haley said it occurred in both, and mine only in the one, No. 8.

Mr. STUART.—He says there is a bend in the web and not in the splice at all; he says the inside web was bending towards Montreal.

Mr. KINLOCH.—That is in the web.

Mr. STUART.—As I understand, he is not speaking of the splice, but of the web later on.

Mr. HOLGATE.—Do you agree with Mr. Haley's description of the bends in chord No. 8-R in the cantilever arm?

Mr. KINLOCH.—No, sir.

Mr. HOLGATE.—As shown on Exhibit 27-B?

Mr. KINLOCH.—That is this bend here (indicating), the shape of it is what you mean; I do not agree with it. The difference between Haley's description and mine is that my bend goes in there (indicating) and he has a straight bulge out on both chords, and mine bulges out at the end the way I understand it.

Mr. DAVIDSON.—Mr. Haley simply intended to indicate, I take it, by this line here (indicating) that on this side of this web there was a bulge outwards; you see that is down the river towards Quebec, that on that side of this web there was a slight bulge outwards towards Montreal. This does not mean at all that it is as large as these two lines indicate (pointing to Exhibit 27-B).

Mr. HOLGATE.—Did not Mr. McLure make accurate measurements of that chord?

Mr. KINLOCH.—From the cover plate only, and Mr. Birks.

Mr. HOLGATE.—We will call on Mr. McLure later to produce the exact figures. You were speaking of the inspection of the work just now, Mr. Kinloch, can you say how often Mr. Hoare inspected the work?

Mr. KINLOCH.—No, I cannot.

Mr. HOLGATE.—Was it frequent?

Mr. KINLOCH.—Yes, he was out there at least once a week. Some weeks he would be out there pretty near every day, and I suppose there have been weeks when he has not been out once.

Mr. HOLGATE.—On these inspections would he accompany you over the structure?

Mr. KINLOCH.—Sometimes me and sometimes Mr. McLure, whichever one happened to be at leisure at the time.

Mr. HOLGATE.—And was that an inspection of the structure or an inspection of the structure made from the track?

Mr. KINLOCH.—An inspection of the structure made from the track and inquiry from us how things were getting on in regard to different points.

Mr. HOLGATE.—Was the method of erection of the anchor arm clearly stated in the blue prints that were prepared in advance by the Phœnix Bridge Company?

Mr. KINLOCH.—Yes, sir, they were changed in some details only.

Mr. HOLGATE.—Were those instructions carried out with those exceptions as far as you know?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—And you were there all the time?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—And did the work of erection show that the plans were ample?

Mr. KINLOCH.—Yes, sir. It was an excellent good rig for doing the work.

Mr. HOLGATE.—And what were these small exceptions that you referred to?

Mr. KINLOCH.—Why, in setting the first steel, some of the lighter members, they had some of the heavier blocks detailed to drift them over; the particular changes that we noticed were in this; instead of using these blocks that took an hour or an hour and a half to take off, they drifted them over with small tackle.

Mr. HOLGATE.—That was just something that might arise?

Mr. KINLOCH.—Through the work. Pretty nearly everything was covered in the plans as first got out, the hooking on of every set of appliances was shown exactly and the position of it and what you had to use; in fact you had simply to follow instructions and the thing would get there itself if you followed the lines laid down.

Mr. HOLGATE.—Then the instructions were sufficiently minute with regard to the placing of the lower chord system, to enable the working gang to do the work with precision?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—That applies generally to the whole of the anchor arm, and would you say that the same applied to the whole of the structure?

Mr. KINLOCH.—Yes, I do not know of any changes; if they were made they were very minor.

Mr. HOLGATE.—Would it be a big job or a small job to lay out beforehand all these detail processes?

Mr. KINLOCH.—It must have been an awful job.

Mr. HOLGATE.—Complicated?

Mr. KINLOCH.—Very complicated, yes, sir. The erection was practically all done in the office before it was put in the field. It must have taken a year of preparation to get the plans out because every single member had its own plan, where it was to be hooked on and what falls were to be used, and when one set of falls was to be taken off and another put on. All these little things were gone into minutely, especially on the important members, and they had special attachments for moving everything figured out; they did not go by guess on anything except the very lightest members, such as the truss floor beams, and things like that that weighed less than five tons.

Prof. KERRY.—You could say that the men who prepared those plans thoroughly understood bridge erection?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—And gave their very best ability to preparing the plant and the plans for that erection?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—When you speak of the plant, you mean what, the travellers and all the handling apparatus?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—And that was included in your description of the general scheme as being well designed?

Mr. KINLOCH.—Yes, sir, I criticised the electric hoists in the start-off. I did not like them, but they panned out to be all right.

Mr. HOLGATE.—All the handling machinery was there that was required?

Mr. KINLOCH.—Yes, sir, in abundance.

Mr. HOLGATE.—And was there anything that was required for the carrying out of the work that was not used ?

Mr. KINLOCH.—I cannot think of anything that I could have done any better with.

Mr. HOLGATE.—In other words, the whole ground you think had been fully covered ?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—And would you put it in this way, would you say that all contingencies had been provided for ?

Mr. KINLOCH.—I think that would be a very good way to express it.

Mr. HOLGATE.—Notwithstanding that it was an exceptional piece of work ?

Mr. KINLOCH.—Well, if it had not been an exceptional piece of work it would not have required all that preparation.

Mr. HOLGATE.—Then, notwithstanding its exceptional character, everything had been fully provided for in your opinion ?

Mr. KINLOCH.—It had ; right on the ground they had Mr. Birks who was the——

Mr. HOLGATE.—I am speaking of the plans and appliances.

Mr. KINLOCH.—I am speaking of him because he was capable of getting them out on a moment's notice. He was the best man on erection I ever saw.

Mr. HOLGATE.—Mr. Birks was ?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—With regard to the progress of riveting, Mr. Kinloch, did you make reports ?

Mr. KINLOCH.—Only daily to Mr. McLure.

Mr. HOLGATE.—Were they in writing or did you just give him a memorandum at the end of the day ?

Mr. KINLOCH.—I gave him a memorandum at the end of the day, they were in a book, and he copied them off into a diary.

Mr. HOLGATE.—Not a formal report.

Mr. KINLOCH.—No, just how many gangs were riveting and how many rivets they drove.

Mr. HOLGATE.—So if any report exists on riveting it would contain the information you gave to Mr. McLure ?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—When joints were bolted up, Mr. Kinloch, whose instructions were necessary in order that the riveting might be commenced and carried out ?

Mr. KINLOCH.—Mine.

Mr. HOLGATE.—From whom did you get those instructions ?

Mr. KINLOCH.—Why, the little green books of the Phœnix Bridge Company had the general instructions for riveting.

Mr. HOLGATE.—But as to the time when that should be done ?

Mr. KINLOCH.—That was at my own discretion.

Mr. HOLGATE.—That was left to your judgment ?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—How did you understand that that responsibility devolved on you ?

Mr. KINLOCH.—It devolved on me only this much, that I was to judge of when a certain condition existed in a member. The orders were to rivet certain members when they came in perfect contact, and I was the judge of when they were in perfect contact. They could not be riveted before they were in perfect contact, so I generally called Mr. McLure in on a matter before we riveted.

Mr. HOLGATE.—You understood that as part of your duty then ?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—As to parts in the field joints near their final position, did you find it necessary from time to time to change the bolts from a smaller to a larger size ?

Mr. KINLOCH.—In some of the members, yes, sir. Not all of them.

Mr. HOLGATE.—Have you any reason why it was not general?

Mr. KINLOCH.—Well, it depended a good deal on where the member was and what sized bolts were in it before.

Mr. HOLGATE.—Then was it the rule that the smaller bolts had to be used first?

Mr. KINLOCH.—Put in just as big a bolt as they could get in the hole.

Mr. HOLGATE.—Then was the inspection frequent enough and complete enough to detect the time at which these bolts should be changed?

Mr. KINLOCH.—Well, there was no movement you know, the movement all came you might say together, when it began to pick and from that forward.

Mr. HOLGATE.—That is there was a regular movement as the work progressed on the cantilever arm?

Mr. KINLOCH.—After a certain period, no, sir; there was not much movement until we got quite a way out, I forget exactly which panel. Mr. McLure can tell you that, but the joints commenced to close and really it is hard for me to remember that. It is all down in record and you can get it better from Mr. McLure than I can give it to you.

Mr. HOLGATE.—Was there always a sufficient force of riveters on the work?

Mr. KINLOCH.—Oh, yes, sir, on this work the riveting was on the bottom chord, mostly all compression members, very few tension members, and as far as I was personally myself concerned, I would just as soon not have seen any of it riveted up to now, outside of a few tension members in the bridge.

Mr. HOLGATE.—So at any rate there was no lack of riveters?

Mr. KINLOCH.—Oh, no, they always had men. They used to work them into other work, they were always there to fall back on to replace men in the raising gang, if a man in the raising gang should stop work they could take a few from the riveting gang.

Mr. HOLGATE.—There was always a sufficient number of riveters to keep the raising gang full?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—After the wreck of the bridge, Mr. Kinloch, I understand that you identified certain members and marked them prior to their being photographed?

Mr. KINLOCH,—Yes, sir, I helped.

Mr. HOLGATE.—You are sure that the identification, as far as it went, was correct?

Mr. KINLOCH.—With one exception.

Mr. HOLGATE.—Which was that?

Mr. KINLOCH.—That is that the picture marked chord 9-L west rib should be west centre rib. That is on that photograph. It should be west centre rib A-9-L (Photograph was marked in accordance with Mr. Kinloch's directions.) That is correct.

Mr. HOLGATE.—I will put in this series of 24 photographs. (Photographs put in and marked Exhibit No. 34.) You assisted in taking the photographs numbered Exhibit 34?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—I understand that you took certain photographs yourself?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—These 21 photographs (referring to a number of photographs) are the ones you took yourself?

Mr. KINLOCH.—Yes, sir.

(Photographs put in and marked Exhibit No. 35.)

Mr. HOLGATE.—We are through with Mr. Kinloch.

Mr. DAVIDSON.—There is one point on which I would like a question to be put to Mr. Kinloch: Has he formed any opinion as to the point at which the break occurred in the bridge when it fell.

Mr. HOLGATE.—No, I won't ask that.

Mr. DAVIDSON.—Of course, it is a suggestion to the Commission.

Mr. HOLGATE.—We must form our opinion on the evidence we get.

Mr. DAVIDSON.—What occurs to me is this : Mr. Kinloch is a gentleman of wide experience in this kind of work. Although not an engineer he certainly must have acquired a vast amount of knowledge and he has shown that he has done so in his examination. He is intimately connected with this work, he actually saw the bridge fall and as a matter of fact he has already stated at the coroner's inquest, where in his opinion, this break occurred. I can quite conceive that it would not in any way bind the Commisisoners. It would simply be an expression of opinion by him in no way binding upon the Commissioners in arriving at a conclusion as to where that break occurred. At the same time it does appear to me that it would be useful to have the opinion of a man like Mr. Kinloch on that point, who was an eye-witness to the fact.

Mr. HOLGATE.—If we can see anything to assist us in asking Mr. Kinloch's opinion, Mr. Davidson, we will not hesitate to ask him, but you can see from the nature of the examination of Mr. Kinloch, that we have tried to extract everything he knows.

Mr. DAVIDSON.—Certainly, there is no doubt about that.

Mr. HOLGATE.—And short of asking him the question you have just asked, we have asked him pretty nearly everything; so that we feel that we have the benefit of Mr. Kinloch's knowledge of the conditions and we also feel that he has not kept anything from us.

Mr. DAVIDSON.—I do not think he has.

Mr. HOLGATE.—Let us leave that entirely as it stands, Mr. Davidson, for a little while. If there is any object to be gained by asking Mr. Kinloch that at a later period we will do so. At the present time I think it would be out of place.

Mr. DAVIDSON.—All right, sir.

Witness retired.

Mr. HOARE, recalled :

Mr. HOLGATE.—Here are some documents from your company. Can you deposit those ?

Mr. HOARE.—I will deposit this agreement between the Government of the province of Quebec and the Quebec Bridge Company of the 27th November, 1900 (Agreement filed and marked Exhibit No. 36), and this agreement between the City of Quebec and the Quebec Bridge Company dated September 22, 1900. (Agreement filed and marked Exhibit No. 37.)

Witness retired.

Commission adjourned to meet to-morrow (Saturday) at ten a.m.

TWELFTH DAY.

QUEBEC, Saturday, September 21, 1907.

The Commission resumed at ten a.m.

Mr. KINLOCH, recalled :

Prof. KERRY.—Mr. Kinloch, we have evidence here that was given by a witness—Delphis Lajeunesse—which we do not quite fully understand. Perhaps you could explain to us just what the witness was doing at that time. I will read you over his evidence first of all. The evidence as quoted here is not exactly my recollection of what Lajeunesse said. He told us that he was bolting

on some splice bars and was standin gup on top of a wooden box for the purpose of hitching on his tackle to lower a box of tools down to his brother who was down below him. There came a sudden jerk on the bridge and he was thrown down in the box that he was standing on. He got up and turned around and looked at the traveller and saw that the traveller was standing there all right; then, he looked at the Quebec truss of the anchor arm and he saw that it was falling towards Quebec. Then, the whole bridge fell and he hung on to the bridge and retained his place until it got down. As a matter of technical fact indicating the character of the failure the evidence is very important, and if you would describe to us just as nearly as you can make out exactly what he was doing at the time it would assist us.

Mr. KINLOCH.—The only splice where it is riveted there is what we call a little buck brace or cross frame for a stiffener inside of the splice (indicating point L on Exhibit No. 26). In all of the splices it is the same. This is left off and he was bolting this on.

Prof. KERRY.—They bolt on to what member ?

Mr. KINLOCH.—They bolt on to the cross member. They take off one of them in order to get in.

Prof. KERRY.—That is speaking of P-2 post ?

Mr. KINLOCH.—Yes.

Prof. KERRY.—The cross brace that they call the buck brace ?

Mr. KINLOCH.—Yes, I am not sure whether there was any place there—whether there was any turn bolt that he could put in, but there were different places where they could not drive the rivets where they would put in turn bolts, and they would fasten the tackle on the diagonal to lower the tools down. His brother was down below and he was letting his tools down to his brother. This box is about eight inches wide and eighteen inches long and five or six inches deep with a handle nailed across the top of it—a piece of board.

Prof. KERRY.—He said he was standing on his box ?

Mr. KINLOCH.—He may have been standng on his box to reach the tackle over his head.

Prof. KERRY.—Where would he be standing ?

(Mr. Kinloch pointed out the position evidently occupied by Mr. Lajeunesse.)

Prof. KERRY.—He was probably standing on the cross strut running from P-2-R to P-2-L and ending near the point marked L on Exhibit 26 ?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—On the cross strut between P-2-R and P-2-L ?

Mr. KINLOCH.—Yes, sir.

Prof. GALBRAITH.—Close to P-2-R ?

Mr. KINLOCH.—He must have just moved there because he was near there a few minutes before. They also cleaned up the bolts that were there and let them down. In fact they were finishing up.

Prof. KERRY.—He would probably up-end his box to reach the tackle ?

Mr. KINLOCH.—No, sir, I do not know that he would; it would be too little a box to up-end and stand on.

Prof. KERRY.—Well, then, the jerk that threw him down would probably have only dropped him four or five inches ?

Mr. KINLOCH.—I do not think he would have stayed there if he had got very much of a jerk.

Prof. KERRY.—His feet would drop in the box. He was probably standing on the edge of the box.

Mr. KINLOCH.—I do not know if you could get your feet in this box or not. I understood him to say that he dropped on his box.

Prof. KERRY.—He could see the lines of the big traveller from there ?

Mr. KINLOCH.—I do not know if he could very distinctly—no. He could see that the traveller was there all right.

Prof. KERRY.—That is all that he said.

Mr. KINLOCH.—He could see probably the top part and he could probably see the little traveller better than the big traveller. There is a big mass of transverse bracing all through there.

Prof. KERRY.—He could see the Quebec truss of the anchor arm very fully?

Mr. KINLOCH.—Yes.

Prof. KERRY.—Then, referring to another point, what was the condition of the riveting on the main diagonals ?

Mr. KINLOCH.—50s and 5 ?

Prof. KERRY.—Yes.

Mr. KINLOCH.—The two top splices down from the centre post were riveted complete, the next splice had no rivets (that is in the anchor arm)—none whatever and the joints were open about—well, from ⅛th to a quarter of an inch, just guessing. I never measured; I was not close, but the next splice down on the Quebec side was riveted complete. On the Montreal side the inside of the truss was riveted and the outside lacked about ⅛th of an inch of being close. That is all the splicing.

Prof. KERRY.—Is that loose splice you mentioned right down at the foot of the diagonal ?

Prof. KINLOCH.—No, it is right at the top.

Prof. KERRY.—How about the connection with P-4 ?

Mr. KINLOCH.—That is a pin connection.

Prof. KERRY.—Right where the main diagonal connects with P-4 there was in that truss a horizontal brace running across the pier connecting with the cantilever arm.

Mr. KINLOCH.—Right at the end of it ?

Prof. KERRY.—Yes ?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Was that riveted up?

Mr. KINLOCH.—No, sir, it was entirely loose.

Prof. KERRY.—It was in place but not fastened?

Mr. KINLOCH.—Not fastened.

Mr. HOLGATE.—At what point?

Mr. KINLOCH.—P-4.

Prof. KERRY.—Was it otherwise fastened?

Mr. KINLOCH.—Riveted at the other end.

Prof. KERRY.—Was it riveted to the T-5-Z members there?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Was it riveted to the main post?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—So that it was practically finished except for one connection at the end of P-4 in the anchor arm?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Why was it left loose?

Mr. KINLOCH.—According to instructions to provide for the movement of the centre post going ahead.

Prof. KERRY.—It had not yet settled in its final position ?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Was it getting nearly into such a position that it could be riveted up finally?

Mr. KINLOCH.—No, the holes were too bad to do anything with it.

Prof. KERRY.—They would be how much out?

Mr. KINLOCH.—I never had it up in position enough to know for sure but I would say that it would be a hole out anyway.

Prof. KERRY.—The whole width of a hole?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Which way—too long or too short?

Mr. KINLOCH.—I think it was too long. I am not positive upon that because I did not pay much attention to it only I noticed it was out.

Prof. KERRY.—It was not considered of very great importance?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Was that on both the Quebec truss and the Montreal truss?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—The members were in the same condition?

Mr. KINLOCH.—The same condition.

Prof. KERRY.—Was the main diagonal of the cantilever arm riveted up?

Mr. KINLOCH.—It had no rivets in it in place?

Prof. KERRY.—Just bolted?

Mr. KINLOCH.—Just bolted.

Prof. KERRY.—Full bolted?

Mr. KINLOCH.—Yes.

Prof. KERRY.—Have you thought of anything you omitted to state in your evidence yesterday?

Mr. KINLOCH.—Mr. Holgate asked me about chord 10-L and I had noticed a bulging on the cover plate.

Prof. KERRY.—Of the anchor arm?

Mr. KINLOCH.—Yes, at the splice of chord 10 and 9, and I called the Indian's attention to it and told him to put a couple of bolts in it and asked him how long it had been in there and he said that it had been there ever since they came.

Prof. KERRY.—That is ever since the gang went there for the purpose of riveting up that joint?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—How long had they been working on the joint?

Mr. KINLOCH.—I think they started on Saturday; I am not sure. Also at the foot of 10, when it was set, it was found that the ribs did not match and we cut a diaphragm.

Prof. KERRY.—They did not match on the stub chord?

Mr. KINLOCH.—No; we cut a diaphragm, jacked the webs over, reamed the holes and held them over there with wedges.

Prof. KERRY.—Reamed which holes?

Mr. KINLOCH.—The holes in the diaphragm. The diaphragm was shop riveted in there and the ribs did not quite match. One of them was off from the other three.

Prof. KERRY.—A matter of how much?

Mr. KINLOCH.—About a quarter of an inch. When Mr. Scheidel came there we called his attention to it and it was his instructions to do that.

Prof. KERRY.—Then you field riveted it after you had reamed the holes out? You replaced the diaphragm with field rivets?

Mr. KINLOCH.—We replaced the diaphragm but whether it was field riveted or not I am not positive. I think it was left at the time; it was wedged there.

Prof. KERRY.—How were the wedges inserted?

Mr. KINLOCH.—A long thin wedge driven down between the end of the diaphragm and the chord rib.

Prof. GALBRAITH.—To widen the space?

Mr. KINLOCH.—To widen the space.

Prof. KERRY.—You spoke of Mr. Scheidel; we have not heard of him before as being on the bridge locally. How often did he visit the bridge?

Mr. KINLOCH.—Only once that I can remember. He may have been here twice, but he was here for quite a while at one time.

Prof. KERRY.—He did not come up in any specific connection, but was simply visiting the works?

Mr. KINLOCH.—I really do not know what he did come up for or whether he just came up on a visit.

Prof. KERRY.—While he was on that visit this particular detail was referred to him?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—If I remember rightly, Mr. Scheidel was responsible for all the detailing of the bridge?

Mr. KINLOCH.—I understood so; yes, sir.

Prof. KERRY.—Did you notice whether the Indians put the bolts in that you directed on that cover plate?

Mr. KINLOCH.—No, I do not believe I did.

Prof. KERRY.—You gave them that direction what day?

Mr. KINLOCH.—Wednesday, I think.

Prof. KERRY.—They were then working on the joint between 9 and 10?

Mr. KINLOCH.—Yes.

Prof. KERRY.—The bulge was on the upper end of 10? The plate had lifted?

Mr. KINLOCH.—Yes, the plate had lifted at the lower end of No. 9?

Prof. KERRY.—The lower end of No. 9 resting on No. 10?

Mr. KINLOCH.—Do you mean that the plate was solid on No. 10?

Prof. KERRY.—Yes.

Mr. KINLOCH.—I am not positive about that. It may have been up a little but not quite as much as it was at the upper end of No. 9.

Prof. KERRY.—How would you detect a defect of that kind?

Mr. KINLOCH.—By looking down through the hole.

Prof. KERRY.—The bolts were out?

Mr. KINLOCH.—What called my attention to it was that I cautioned them about taking the drift pins out, and told them why I wanted the drift pins left in, and I just looked through the hole and saw the plate was up. I told them to draw that plate down.

Prof. KERRY.—A matter of how much, do you suppose?

Mr. KINLOCH.—A quarter of an inch.

Prof. GALBRAITH.—Was that the condition all across the chord of the plate away from the angle iron all along the chord on the four ribs?

Mr. KINLOCH.—No, it was bolted on the edge and in the centre they only had drift pins in because it is about five feet to reach up and you cannot hold the bolt to put it in without special preparation and the instructions are to put drift pins in.

Prof. GALBRAITH.—What was the space between?

Mr. KINLOCH.—I suppose it was a gradual hump from one to the other; it was not a short bend or kink.

Prof. KERRY.—On the opposite edges it would probably be drawn down tight?

Mr. KINLOCH.—Yes, sir, it was drawn down tight.

Prof. GALBRAITH.—A gradual curve from one edge to the other showing the biggest space in the middle?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—On the opposite side the joint was full riveted on 9 and 10?

Mr. KINLOCH.—Yes, that gang had just moved over.

Prof. KERRY.—That is on the Quebec side?

Mr. KINLOCH.—Yes.

Prof. KERRY.—Do you think you have told us, Mr. Kinloch, every indication that you know of that could help us to find out the cause of the failure?

Mr. KINLOCH.—To the best of my memory, I have. There may be some small things in there, but I did not think they would have any bearing on the thing. There may be some little errors in there that I have not thought of.

Prof. KERRY.—Every reason you have got for forming personal opinions you have given to us?

Mr. KINLOCH.—Yes, sir. I might say that there was a slight error in punching in the anchor section of the main diagonals, but they would not have anything to do with it. That joint was completely riveted up, but there were some holes that were bad; in fact they were blind, and we had to put some re-enforcing plates on that. Mr. McLure has a sketch of the plate which will show that.

Prof. KERRY.—That is on the main diagonal?

Mr. KINLOCH.—Yes, sir, on the Montreal side.

Prof. KERRY.—In the evidence given by the witness, Alexander Beauvais, he mentioned that directly previous to the accident his working partner saw one rivet right on that 9 and 10 joint broken and very shortly afterwards another one broke. In ordinary practice is the failure in a comparatively short time after driving of field rivets a usual thing?

Mr. KINLOCH.—No, it is not a usual thing, but it happens sometimes.

Prof. KERRY.—It happens sufficiently frequently for you to assume that the fault is in the rivet generally?

Mr. KINLOCH.—Generally we do not pay any attention to it. You might hear some remark about it by the gang driving the rivets, but it would not alarm anybody.

Prof. KERRY.—You would lay the blame on the men driving the rivets rather than on the structure?

Mr. KINLOCH.—Yes, sir, you would think that it was in the rivets, not in the structure.

Prof. KERRY.—And if you saw two going close together you would still not be alarmed?

Mr. KINLOCH.—I do not know; no.

Prof. KERRY.—In addition he said that they saw the ribs bending away from the cover plate.

Mr. KINLOCH.—The side cover plate?

Prof. KERRY.—I imagine the cover plate of the rib he was working on. He was working on one of the two inside ribs. What would you have thought of that?

Mr. KINLOCH.—If I had seen it I would have been going yet.

Witness retired.

Mr. McLURE, recalled.

Prof. KERRY.—I think you might just go over the different points as Mr. Kinloch did. First of all, tell us about each of the unexpected happenings that came to your notice on the bridge and what was done in regard to them?

Mr. McLURE.—I could be able to do that better out of my books.

Prof. KERRY.—Are the books in the possession of the Commission just at present?

Mr. McLURE.—No, sir, they are right here.

Prof. KERRY.—Take your books, please? (Witness produced a note-book.)

Mr. HOLGATE.—Is that a private note-book?

Mr. McLURE.—No, sir.

Mr. HOLGATE.—Has it got the information?

Mr. McLURE.—It has got a record of the things I found on the bridge. I think very nearly everything is in there. There may be a few things I have in my diary that I have here and there may be a few things that are not in here that will be in my correspondence with Mr. Cooper. I cannot attempt to recall all those things to mind now. The book is entitled, 'Record of shop errors found in field during erection.'

(Note-book put in and marked Exhibit No. 38).

Prof. KERRY.—By reference to the book you can go over your ground thoroughly?

Mr. McLURE.—I think so.

Prof. KERRY—I think it would be well to have your own statement.

Mr. McLURE.—Do you want me to cover the ground that Mr. Kinloch covered too, because everything he stated to you I have seen myself.

Prof. KERRY.—Very largely, Mr. McLure, because in a good many cases Mr. Kinloch left his evidence incomplete for reference to you for the facts?

Mr. MCLURE.—I have not got the dates down here (referring to Exhibit No. 38). The first thing I can remember that we came across in the erection that had to be rectified was in the batten plates on the dummy chords A-O-O—R and L at the connection to the top of the post P-1-R-L. These batten plates interfered with entering the chords and we had to cut them off. We referred the matter to Mr. Cooper and the Phœnixville office and we were instructed to leave them off.

Mr. HOLGATE.—It is a pity you cannot give the date of that.

Mr. MCLURE.—I will tell you when it was—September, 1905.

Mr. HOLGATE.—Can you say that the exhibit is a record of all the shop defects found in the field?

Mr. MCLURE.—Yes, shop defects and every other kind of defects.

Mr. HOLGATE.—All?

Mr. MCLURE.—All except, as I said before, perhaps one or two that I have in my correspondence or diary that would not be in here, but I cannot think of any now that I have not included in here.

Prof. KERRY.—I think you were just taking up, Mr. McLure, a case that you considered it necessary to refer to a higher authority for advice?

Mr. MCLURE.—This is on April 21, 1906. At the connection of diagonal A-T-4, with top chord of truss floor beam A-F-B-8 of the anchor arm 7 holes on each side of the diagonal A-T-4 did not match the holes in the floor beam. This was referred to Mr. Cooper and Phœnixville, it was thought that it should be reinforced and a plate was furnished to put on over the connection plate and holes drilled through from the strut to the plate.

Prof. KERRY.—A reinforcing plate was supplied, drilled in place and riveted?

Mr. MCLURE.—No, sir, it was never put on. Mr. Cooper said that it was not necessary. But it was provided by the Phœnix Bridge Company.

Prof. KERRY.—Provided but not put on?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Were the holes, where necessary, left unfilled?

Mr. MCLURE.—No, sir; the holes were drilled through the original connection, the plate without the re-enforcing plate, and riveted that way. In the connection between S-V-5-L on top of hanger A-U-T-5-Z-L of anchor arm, two horizontal rows of holes on the inside did not match by an inch and a quarter. These were the holes that connected the big truss anchor and the top splice plate on the hanger. A sketch was sent in to Phœnixville by Mr. Birks, and a re-enforcement plate provided for that connection and riveted on there only recently. I have not the date for that.

Prof. KERRY.—Will these sketches be among the file of plans?

Mr. MCLURE.—I have a sketch of it here.

Prof. KERRY.—Put in by Mr. Hoare?

Mr. MCLURE.—Put in by Mr. Hoare.

Prof. KERRY.—Mr. Hoare has supplied us with the Quebec bridge plans.

Mr. MCLURE.—No, I do not believe it will be. Then, as Mr. Kinloch has already said, there was a slight dish found on the top centre post section C-P-1-R and L after the brackets were riveted on. That was referred to Mr. Cooper and his suggestions followed in the matter when it was erected.

Prof. KERRY.—What were the suggestions?

Mr. MCLURE.—To get a certain percentage of bearing area before we allowed it to be erected. That is in the correspondence.

Prof. KERRY.—His instructions were carried out?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Did you note that joint at any subsequent time?

Mr. MCLURE.—Yes, sir, I think I did. I remember looking at it—I do not remember just what date, but this year some time. Of course, it was a joint between two

flat plates, and it was spliced up with these splices on the sides, so that practically all you could see were the corners.

Mr. KERRY.—The spliced plates that you remember seeing in the two finished surfaces were in good contact?

Mr. McLURE.—Yes, sir. At the time of the erection of that joint Mr. Birks and I took some thin steel feelers and went down in the sections, in the manholes in the two plates that come together, and slipped this in and around the edges to see how the bearing was actually. I have a record of that. The top cover plates over centre posts C-P-R & L that connect the top laterals on the cantilever arm side did not fit the connecting angles in the post sections. On the west truss it was not a sufficiently bad fit to make any change in the metal, so that the holes were reamed. On the east truss in the connecting angles they were sent from Phœnixville in the blank, taken up there and drilled to fit. Mr. Kinloch has already mentioned a warp in the base plate of the east shoe that was found at the time of setting the shoe in August, 1905. It ran through in a longitudinal direction in the east half of the shoe, the maximum being $\frac{1}{8}$ths of an inch. This was reported, and the instructions were to watch it and see if the weight placed on the shoe would take that warp out. Subsequent inspection showed that the weight had taken the warp out, but not altogether.

Prof. KERRY.—Were any repairs made?

Mr. McLURE.—No, sir.

Prof. KERRY.—That was the joint between——

Mr. McLURE.—Between the top pedestal and the shoe.

Prof. GALBRAITH.—That was a warp that was in it when it arrived and was delivered at the bridge?

Mr. McLURE.—We did not notice it until we set it and compared it with the top plate of the pedestal.

Prof. KERRY.—It remained to the end as a minor but permanent defect?

Mr. McLURE.—I could not say about the end; the last time I saw it it was not entirely up. We had instructions to plug it up with red lead or paint filler to prevent moisture getting in, and you could see in the squeezing out that it was settling and that it had not altogether closed.

Prof. GALBRAITH.—What was the thickness of the plate?

Mr. McLURE.—I think it was a 3-inch plate planed down to $2\frac{1}{4}$ inches. In the transverse strut belonging to truss 4-B-F-B-9 of the cantilever arm—the bottom transverse strut—the end of the connection plates had to be chipped slightly in order to enter them in the connection at the feet of posts P-4.

Prof. KERRY.—What date?

Mr. McLURE.—I have not the date for that, but it must have been in August, 1906. They were chipped off and four rivet holes removed from one of the plates at the chord I refer to. The thickness was two plates, and reports were sent in in the regular way about it.

Prof. KERRY.—What would be the amount chipped off?

Mr. McLURE.—About 16 square inches.

Prof. KERRY.—In length, I mean?

Mr. McLURE.—I have a sketch of it.

Prof. KERRY.—I understand that the transverse strut was too long? (The witness here explained the detail of this alteration from his notes in Exhibit No. 38) and continued: On the end post of the cantilever arm at the connection to the north ends of the end bottom chords we found on the south side of the posts the plate lapping over the chord extended too far down and this was evidently a mistake in reading the drawing. The chord was chipped in the field to fit the post and a note sent of it to the shop and the posts for the north side we remodelled accordingly. In the tops of the end posts on the cantilever arm the outstanding legs of four vertical stiffener angles had to be chipped about an inch and a half to admit the connecting link for

the suspended span. I guess that is all. I did not read over all but those are all the ones that were rectified as I remember.

Prof. KERRY.—In general, Mr. McLure, would you say that in all details the shop work was exceedingly satisfactory?

Mr. McLURE.—Yes, sir.

Prof. KERRY.—The errors that you found either in the dimensions of members or in the provisions for riveting were very few?

Mr. McLURE.—Very few indeed.

Prof. KERRY.—And for the field riveting the holes were found to match well?

Mr. McLURE.—I cannot speak with as much authority on that as Mr. Kinloch, but considering the number of holes, I should say that they matched very well.

Prof. KERRY.—Mr. Kinloch mentioned two or three places where there were cracks in members. You might speak about them?

Mr. McLURE.—There was one crack in a finished plate for the bottom strut of truss floor beam F-B-8 at the foot of Post P-4 on the south anchor arm. It was noticed that the plate was cracked shortly after its erection and a report was made of it and a repair plate furnished and put in place. I do not recollect any other cracks except one or two lattice angles had the outstanding leg cracked on some of the transverse braces.

Prof. KERRY.—No members were erected that were known to be cracked at the time, Mr. McLure?

Mr. McLURE.—No, sir. Yes, there was one transverse diagonal that had the outstanding leg of the lattice angle cracked; that was erected, a note made of it and the understanding was it was to be cut off and a new angle put on.

Prof. KERRY.—Was that done?

Mr. McLURE.—No, sir, it has never been done yet; it is out on the end of the cantilever arm.

Prof. KERRY.—Where would the record of that be?

Mr. McLURE.—In another book there. (Book produced, filed, and marked Exhibit 39). Shall I read it, about that lattice angle?

Mr. HOLGATE.—Yes, or note what page it is.

Mr. McLURE.—It is page 5 of Exhibit 39. 'Transverse diagonal 671-T. 71 south cantilever arm. Third lattice angle from the top bend on this diagonal has its outstanding leg cracked, and must be replaced.'

Prof. KERRY.—We had some evidence dealing with the crinkling up of the joint of a bend in the plates between the centre post and S-P-5.

Mr. McLURE. S-P-5, yes, sir. I had correspondence with Mr. Cooper about that.

Prof. KERRY.—Your correspondence with Mr. Cooper and Mr. Kinloch's evidence cover that point perfectly.

Mr. McLURE.—Yes, sir.

Prof. KERRY.—Then you have now covered all the actual difficulties that you noted, either by exhibits or your statements.

Mr. McLURE.—Yes, as near as I can recollect now.

Prof. KERRY.—And there has been certain evidence given with regard to cracked plates in the vicinity of the base of the centre post? Different witnesses have mentioned different plates as cracked. Can you give any evidence bearing on those?

Mr. McLURE.—I never saw any cracked plates there.

PROF. KERRY.—How thoroughly and how often would you have inspected that part of the bridge?

Mr. McCLURE.—I cannot say exactly as to how often, but when I inspected it I inspected it thoroughly enough to see a crack of any magnitude at all.

Prof. KERRY.—Will you say positively that all the plates around the base of the centre post had been inspected since June 15 by you?

Mr. McCLURE.—Yes, sir.

Prof. KERRY.—And that to your observation there was no crack in any one of them ?

Mr. MCLURE.—No, sir, not the slightest.

Mr. DAVIDSON.—Might I suggest to the commissioners that the witness be asked if he could account in any way for the very positive statement made by three witnesses that they saw cracked plates ?

Mr. HOLGATE.—Which witnesses ?

Mr. DAVIDSON.—Ouimet——

Mr. HOLGATE.—Ouimet has not come before us.

Mr. DAVIDSON.—No, of course his statement was at the coroner's inquest, but the other two, Davis and Lafrance, they were cross-examined on the point, they were asked if it was possible they could be mistaken, if they could have mistaken something else for a crack and notwithstanding that they still maintained that it was cracks that they saw. I would like to know if Mr. McLure can account for that in any way.

Prof. KERRY.—What explanation would you offer of any appearances that could have misled these witnesses ?

Mr. MCLURE.—The only explanation I could offer would be that they might have seen a crimp in the plate from Lafrance evidence; of course I cannot locate even the plate he saw it on. From Mr. Davis' evidence the crimp and the crack that he said he saw are in exactly the same place.

Prof. KERRY.—Could you make a sketch as a matter of evidence showing a section through the plate right at the crimp to show how sharply the plate was bent there?

Mr. MCLURE.—I do not know from memory if I can. I can try it.

Prof. KERRY.—Just a transverse section through the plate.

Mr. MCLURE.—Yes, sir.

Mr. STUART.—I am told that Mr. Edwards has an actual sketch of that crimp which was referred to Mr. Cooper; he can produce it.

Mr. HOLGATE.—Perhaps it would facilitate Mr. McLure's explanation if something like that were here.

The witness made a sketch which was filed and marked as Exhibit 40.

Prof. KERRY.—Would it be possible, Mr. McLure, that a crack in the paint would look like a crack in the plate itself ?

Mr. MCLURE.—It might look like a hair crack, but not like a crack $\frac{1}{4}$ of an inch wide.

Prof. KERRY.—The evidence of the witness Davis was directed towards a narrow crack, not $\frac{1}{4}$ of an inch wide.

Mr. MCLURE.—Yes.

Prof. KERRY.—Have you ever been misled personally by any such surface cracks ?

Mr. MCLURE.—No, sir, not that I recollect; I always carry something around to scrape the paint off.

Prof. KERRY.—Have you been misled to the extent of requiring to scrape the paint off to make sure ?

Mr. MCLURE.—I do not remember any particular instance.

Prof. KERRY.—Passing from errors and cracks, Mr. McLure, what can you tell us about the deformations of the members that have been observed?

Mr. MCLURE.—In all the compression members, especially those with heavy webs, we have noticed more or less deformation in the webs.

Prof. KERRY.—That is in advance of erection?

Mr. MCLURE.—In advance of erection, yes, sir.

Prof. KERRY.—The deformation would amount to how much?

Mr. MCLURE.—I do not think in any case over three quarters of an inch and not

usually as much as half an inch. I do not remember the figures, we measured a few and sighted along a greater number.

Prof. KERRY.—You would not be able to observe whether that deformation ran completely across the ribs or not, your observation would be mainly confined to the upper surface, would it not?

Mr. MCLURE.—The only way you could observe that would be by measuring the ribs with a line, top and bottom.

Prof. KERRY.—Was that done in any cases?

Mr. MCLURE.—I do not remember except in the cases of the chords in place that we measured recently.

Prof. KERRY.—Then to the best of your knowledge no members went into the bridge with deformation in excess of the neighbourhood of half an inch?

Mr. MCLURE.—No, sir.

Prof. KERRY.—And you inspected all the members before they were placed in the bridge for that among other defects, did you?

Mr. MCLURE.—I did all members with the exception of the first nine bottom chords of the south anchor arm, which were placed before I arrived on the work.

Prof. KERRY.—The first nine. Which would the first nine be specifically?

Mr. MCLURE.—From one to nine inclusive.

Prof. KERRY.—On one side?

Mr. MCLURE.—Both sides.

Prof. GALBRAITH.—When you say the deformation was not more than one half inch, how is the deformation measured; what base line do you measure from; between what points are you taking the measurement?

Mr. MCLURE.—Usually the total length of the latticing, I think.

Prof. GALBRAITH.—A straight line from one end to the other?

Mr. MCLURE.—I do not remember exactly how we did measure them all.

Prof. GALBRAITH.—You are estimating by eye from a straight line?

Mr. MCLURE.—No, actual measurement with a rule.

Prof. GALBRAITH.—Did you stretch a line from one end to the other?

Mr. MCLURE.—From one end to the other as far as we could get in some. I do not remember whether in every case we went from one end to the other with the line, because it would not be possible to do it on account of the connections at the end, but I think we covered the latticing in every case to a batten plate.

Prof. GALBRAITH.—You went from one batten plate to the other with the line?

Mr. MCLURE.—There is not always a batten plate at each end of a compression member; that is, a splice plate acts as a batten plate when fully riveted on, and in the condition in which we made these measurements a splice plate would not be on.

Prof. GALBRAITH.—The line would be roughly in the neighbourhood of 50 feet?

Mr. MCLURE.—I cannot give you any general rule.

Prof. GALBRAITH.—What I want to get at is whether you are speaking of local deformations measured from a short base line, say from 5 to 10 feet or whether you are speaking of a general deformation of the whole web taken from a base line as nearly as possible from end to end.

Mr. MCLURE.—That is what I was referring to.

Prof. GALBRAITH.—And you say that it was in the latter way that the measurement was taken?

Mr. MCLURE.—Yes, sir.

Prof. GALBRAITH.—And the deformations, as far as you know, did not exceed one-half inch?

Mr. MCLURE.—Yes, sir, to the best of my recollection.

Prof. KERRY.—Now, you might tell us all that you know about the subsequent deformations?

Mr. MCLURE.—I watched the main post for subsequent deformations and never found any. The post P—4 anchor and cantilever arm, at the time of the collapse of the

bridge, had already received their maximum compression stresses as well as post P—3. I had watched all these posts for deflections and never could detect any. Also some of the sub-diagonals connected to these posts. The intermediate verticals between these posts I had watched for signs of buckling but never detected any. In the centre post particularly I had watched together with Mr. Kinloch to detect when the different sections would be exactly in line across the splices and we had observed that centre post numerous times at a not very remote date and from our observations it was perfectly in line.

Prof. KERRY.—The joints of the post were bearing full ?

Mr. MCLURE.—Yes, sir, every one of them.

Prof. KERRY.—And the post itself, as far as you could observe, was perfectly true?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—It was swinging on the main pin?

Mr. MCLURE.—It had freedom to turn on the main pin.

Prof. KERRY.—At no very remote date, you say; you mean any time last month?

Mr. MCLURE.—Yes, sir, not any longer ago than that.

Prof. KERRY.—A month previous to the accident?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Then with regard to the chord sections?

Mr. MCLURE.—I think the first thing my attention was called to in regard to bending in the chord section was the splice between chord 7 and 8-L on the cantilever arm, which had one of the inner ribs bent in towards the other one between the diaphragms, a maximum of three-quarters of an inch right at the splice. That did not extend entirely to the top of this rib although it did slightly, that is it was not three-quarters of an inch at the top but it was I forget how much, something less.

Prof. KERRY.—The lining at the top of the two ribs, 7 and 8, was not perfect?

Mr. MCLURE.—Not perfect but less out of line than the beam. It was measured very carefully by Mr. Birks and myself and reported with a recommendation to insert a diaphragm between the inner ribs extending upward six rivets, I think.

Prof. KERRY.—That is a diaphragm connecting the two inner ribs ?

Mr. MCLURE.—Yes, sir, and I think Mr. Cooper did not approve of that method.

Prof. KERRY.—In any case the recommendation was not carried out?

Mr. MCLURE.—No, sir, not yet. I believe it was being discussed at the time of the accident between Mr. Cooper and the Phœnix Bridge Company.

Prof. GALBRAITH.—By the top do you mean the north end of the chord?

Mr. MCLURE.—No, the top and bottom of the rib.

Prof. GALBRAITH.—Four or five feet between?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Was that the only case of failure to line that had come to your attention, Mr. McLure?

Mr. MCLURE.—No, there was something similar at the splice between chord 8 and 9.L on the cantilever arm. It was only $\frac{1}{8}$ of an inch out of line. The same rib at the bottom of the rib, the top of the rib was perfectly safe. That was not reported because it was not considered of sufficient importance and any reinforcement that might be recommended for the chord that was out of line three-quarters of an inch would apply to the other.

Prof. KERRY.—Were these deflections corrected before the joint plates were riveted on?

Mr. MCLURE.—They never were corrected.

Prof. KERRY.—These joints have not been riveted ?

Mr. MCLURE.—No, sir, not completed.

Prof. KERRY.—Is it a customary thing to find when the riveting was about to commence, that there were little errors in lining between the ribs?

Mr. MCLURE.—Errors of lining but not errors of alignment except the two instances I have mentioned. Errors of lining I should take to mean that one rib did not match the other at the end exactly.

Prof. KERRY.—That is what I mean ?

Mr. MCLURE.—Yes, sir, I found several of those errors on the anchor and cantilever arm both and they always occurred on one of the two inner ribs at the bottom. One splice in the cantilever arm, I forget which one it was, the error did not amount to more than one-quarter of an inch. It was referred to Mr. Cooper in my correspondence and he replied to do the best we could with it. I described our method of jacking the rib back, but he said to make the best job we could with it.

Prof. KERRY.—Would the wind in the rib extend far back or would it start at the diaphragm plate and be just a little local twist ?

Mr. MCLURE.—Well, it is so small you could not detect it with your eye. It was just by having the two not matched that you could tell there was any at all.

Prof. KERRY.—It was never permitted to start to rivet up any of these chord joints until the two adjoining sections were in contact from the top joint to the bottom ?

Mr. MCLURE.—Yes.

Prof. KERRY.—That was the practice followed?

Mr. MCLURE.—Yes, that was the practice; there never was any riveting done until an attempt was made at least to get them into perfect contact. Of course there were slight variations; it was not possible to jack a thing back all the way, I think.

Prof. KERRY.—You are misunderstanding me for the minute. I understand that as far as the lining of the ribs of two adjacent sections is concerned, that they were jacked into line as closely as possible?

Mr. MCLURE.—Jacked into line as closely as possible.

Prof. KERRY.—And then side plates were put on, and then they were riveted in that position?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And the deviation at the time you left them would probably not be as great as one-sixteenth of an inch ?

Mr. MCLURE.—No, sir.

Prof. KERRY.—Considering the ends of two adjacent chord sections, they would have been put in in most of the cases you have mentioned with the upper ends in contact and with the camber taken care of by an opening in the bottom?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Before the riveting was commenced, and at the time of this jacking and interlining, would those joints be closed up perfectly?

Mr. MCLURE.—No riveting was ever started on any joints in a chord before they had a full bearing.

Prof. KERRY.—They were carefully inspected for that ?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Would you show us, by sketch, what the method of jacking was?

Mr. MCLURE.—I do not think I could. It was customary to support the jack against the other inner rib and to transfer part of the pressure to the next outer rib by means of a wooden shore.

Prof. KERRY.—Was any precaution taken, Mr. McLure, to get the four ribs in their correct relative positions to one another when finally jacked into position? If I remember rightly, in each case the four ribs were held by diaphragm plates within four feet of the joint?

Mr. MCLURE.—Yes.

Prof. KERRY.—So that any alteration in the correct theoretical spacing of ribs was either a shop error or it would be a bend that would occur in the last four feet of the rib?

Mr. MCLURE.—No, because these diaphragms do not extend the full length of the rib, they only extend about half way down or a little over, I think.

Prof. KERRY.—Was it possible for one of these ribs to warp below the diaphragm?

Mr. MCLURE.—I should think so; this bend that caused the imperfect bearing might extend back of the diaphragm at the bottom, and, as I said before, all the imperfect matchings that were noticed were at the bottom.

Prof. KERRY.—That wind might start further back than the diaphragm ?

Mr. MCLURE.—Yes, I should think so.

Prof. KERRY.—And would the spacings between the ribs be correct when you finished jacking, or how much would they be in error?

Mr. MCLURE.—I do not think they ever measured it.

Prof. KERRY.—You never measured it?

Mr. MCLURE.—No, sir.

Prof. KERRY.—How would you determine when it became a question of jacking one rib out and the other in? How would you determine which to work on, or would you jack both?

Mr. MCLURE.—We would jack the rib which seemed to be out of line, but that would be a matter of judgment.

Prof. GALBRAITH.—Was the riveting of the diaphragm you speak of done in the shop?

Mr. MCLURE.—Yes, sir.

Prof. GALBRAITH.—Or done in the field, or done sometimes in one place and sometimes in the other.

Mr. MCLURE.—The diaphragms Mr. Kerry referred to as being back of the splice about four feet were riveted in the shop entirely, I think.

Prof. GALBRAITH.—Going back to that 7-8 joint in the cantilever arm, that ¾ of an inch deviation, was that entirely in one rib?

Mr. MCLURE.—Yes, sir, entirely.

Prof. GALBRAITH.—The other three ribs lined correctly?

Mr. MCLURE.—The other three lined correctly.

Prof. GALBRAITH.—Were there any instances to your knowledge, Mr. McLure, in which the side plates had to be bent to bear up correctly against the two chord members?

Mr. MCLURE.—No, sir, not to any extent.

Prof. GALBRAITH.—So far as you know in each case the side plate that was set on the outside was a plane surface?

Mr. MCLURE.—Yes, sir.

Prof. GALBRAITH.—So that beyond this deviation of the inner ribs you have mentioned you were not aware of any defect in the lining of the adjacent chords ?

Mr. MCLURE.—Not at the splice. I said I did not know of any splice plate that had to be bent. I wish to qualify that by saying that at the splice between 7 and 8-L the splice plate on the rib that was bent was riveted on and that splice plate——

Prof. GALBRAITH.—That is on an inner rib ?

Mr. MCLURE.—An inner rib.

Prof. GALBRAITH.—As far as you know the spliced ribs on the outer rib at the same point were true ?

Mr. MCLURE.—Yes, sir.

Prof. GALBRAITH.—What defect did you notice in the chord members, not at the splices but between the splices, along the length of a member ?

Mr. MCLURE.—My attention was called by Mr. Kinloch to the bends in chord A-9-L in the anchor arm, and 8 and 9-R in the cantilever arm.

Prof. GALBRAITH.—At the same time or different times ?

Mr. MCLURE.—At the same time.

Prof. GALBRAITH.—But you have heard of those defects of those three chords at the same time ?

Mr. MCLURE.—I believe he mentioned something about the cantilever arm two or three days before he called my attention to the anchor arm, but I do not remember just what he said, I just have a faint recollection of him saying something.

Prof. GALBRAITH.—You did not make any inspection of those ?

Mr. MCLURE.—Not at that time.

Prof. GALBRAITH.—And the first inspection you made personally was when Mr. Kinloch called your attention to the A-9-L chord on the anchor arm?

Mr. MCLURE.—Yes, sir.

Prof. GALBRAITH. Did you say he called your attention to A-9-R?

Mr. MCLURE.—No.

Prof. KERRY.—I think somebody mentioned yesterday without going into the evidence, Mr. McLure, that you were sick shortly previous to the failure of the bridge?

Mr. MCLURE.—Yes.

Prof. KERRY.—Between what dates would you have been absent from the bridge?

Mr. MCLURE.—Between Saturday afternoon, August 17, and Friday morning, August 23.

Prof. KERRY.—Then probably just on your return Mr. Kinloch mentioned something about it?

Mr. MCLURE.—I think it was the afternoon of my return.

Prof. KERRY.—The chords on the cantilever arm?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—When did he draw your attention to the A-9-L on the anchor arm?

Mr. MCLURE.—On Tuesday morning, August 27.

Prof. KERRY.—About the middle of the morning?

Mr. MCLURE.—About 9.30.

Prof. KERRY.—What action was taken?

Mr. MCLURE.—We went immediately with Mr. Birks to the chords, first to A-9-L, and took measurements, with a line stretched from the edge of the batten plate to batten plate.

Prof. KERRY.—You measured the off-sets?

Mr. MCLURE.—Measured the off-sets along the line at every panel point of the lattice ends.

Prof. GALBRAITH.—What sort of line?

Mr. MCLURE.—A bit of string, fish line, I think it was.

Prof. GALBRAITH.—Have you a record of these measurements with you?

Mr. MCLURE.—Yes, sir.

Document produced, filed and marked Exhibit No. 41.

Prof. KERRY.—This exhibit No. 41, shows the measurements taken at that time?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—As soon as you took those measurements, Mr. McLure, what followed?

Mr. MCLURE.—Pretty shortly after that we went to lunch.

Prof. KERRY.—That is to say you measured the one chord 9-L and then went to lunch?

Mr. MCLURE.—Measured the three of them. It took pretty nearly till lunch, and then 9-R cantilever and then 9-L in the cantilever arm.

Prof. KERRY.—You went immediately over and measured those as well?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Then what followed?

Mr. MCLURE.—Well, at lunch we talked it over at the bridge.

Prof. KERRY.—We, would mean whom, in that case?

Mr. MCLURE.—Mr. Birks, Mr. Yenser, and, part of the time, Mr. Kinloch, I think, and myself; and we decided to report immediately with sketches.

Prof. KERRY.—To whom?

Mr. MCLURE.—To Mr. Cooper and to the Phœnix Bridge Company.

Prof. KERRY.—Did you discuss at that time as to whether any more work should be done or not?

Mr. MCLURE.—Yes.

Prof. KERRY.—Pending those reports?

Mr. MCLURE.—Yes.

Prof. KERRY.—And your conclusion was?

Mr. MCLURE.—There was not any definite conclusion reached at that time. I think Mr. Yenser said it was his intention not to add any more work to the bridge until we found out what was causing the condition of the chords.

Prof. KERRY.—Was your own opinion of the advisability of adding any more weight, expressed?

Mr. MCLURE.—Yes.

Prof. KERRY.—And to what effect?

Mr. MCLURE.—I said at the time I thought it would be poor policy to either move the traveller or add more weight, because if anything had to be done to rectify those chords, it could be easier done at that time than after the stress had been increased.

Prof. KERRY.—You were convinced that those deflections had occurred after the members were placed in the bridge?

Mr. MCLURE.—I was convinced of that in the case of chord 9-L of the anchor arm. Of the chords in the cantilever arm I was not sure.

Prof. KERRY.—You did not consider that there was any possibility of the A-9-L chord in the anchor arm recovering itself?

Mr. MCLURE.—You mean getting back into line again?

Prof. KERRY.—Yes.

Mr. MCLURE.—No, sir; I did not see it could. I do not know that I ever thought of it doing that at all.

Prof. KERRY.—You would not, as an engineer, consider that a column that was once forced out of line by direct thrust along its axis, could possibly recover itself while that thrust remained on the column?

Mr. MCLURE.—No, not without the application of some exterior force.

Prof. KERRY.—That is to say it was recognized at the time that some action had to be taken to straighten up that member?

Mr. MCLURE.—I thought so, yes.

Prof. KERRY.—And your decision was to report immediately to Mr. Cooper the condition of affairs?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And you had also the statement of Mr. Yenser that he did not propose to place any more load on the member until he was further advised by the proper authority?

Mr. MCLURE.—Yes, I was so convinced that that was his determination that I mentioned that in my letter to Mr. Cooper.

Prof. KERRY.—What further action did you take then?

Mr. MCLURE.—I took the rest of the day to get that report off.

Prof. KERRY.—You wrote a report to Mr. Cooper, which went off that evening?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Fully describing the situation?

Mr. MCLURE.—With sketches.

Prof. KERRY.—And then what further action?

Mr. MCLURE.—I called up Mr. Hoare on the telephone, and told him I would like to see him that afternoon, and went in to see him in Quebec. I explained the situation to him and we talked it over. I suggested going to Phœnixville and New York, and he seemed to think it would be a good plan. He told me first to go out in the morning and examine all connections in the bridge that could possibly have any relation to those members, and see if I could find any further cause of trouble, also to run the levels of the main pier.

Prof. KERRY.—These instructions were carried out?

Mr. MCLURE.—Yes, sir, by Mr. Kinloch and myself.

Prof. KERRY.—And you found no alterations in the levels of the main pier?

Mr. MCLURE.—Not the slightest.

Prof. KERRY.—And you found no further indications of trouble?

Mr. MCLURE.—No further indications of trouble whatever, in any other members than the ones mentioned.

Prof. KERRY.—You noted immediately in the morning that Mr. Yenser had changed his decision?

Mr. MCLURE.—Almost immediately.

Prof. KERRY.—Did you take any action with regard to that?

Mr. MCLURE.—No, sir, I told him I thought it was poor policy, that was all.

Prof. KERRY.—You told Mr. Yenser——

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—That you thought it was bad judgment on his part to do so?

Mr. MCLURE.—I do not think I said bad judgment; I think I said poor policy. Mr. Birks and I had already figured that moving the traveller would increase the stress on that chord a very slight amount. I think I got 70 pounds a square foot and he got 50 pounds a square foot as the increased stress; that is about one-half of one per cent of the stress it was receiving at that time.

Prof. KERRY.—You were both trained engineers, Mr. McLure, and did it occur to you in connection with that investigation that a column that had been bent out of line under stress along its axis is likely to go on and continue to bend out of line under the same stress?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—At a more rapid rate?

Mr. MCLURE.—I do not know that the rate entered into my thoughts, but I fully understood that a column out of line is more apt to bend than it would have been if it had been straight, under the same stress.

Prof. KERRY.—You were perfectly clear in your own mind that the safe unit stress on a column bent out of line is considerably less than the safe unit stress on a column that is perfectly true?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And what ground did you take with regard to the small increase of stress which the movement of the traveller would produce in the member?

Mr. MCLURE.—In my own mind I did not consider it would do any particular harm to move the traveller.

Prof. KERRY.—You did not think that the increase in the stress itself——

Mr. MCLURE.—Would be sufficient to cause any trouble with that chord. To prove that I walked out behind the traveller while they moved it.

Prof. KERRY.—We are to understand there was just the one definite measurement made for that chord?

Mr. MCLURE.—That is all to my knowledge.

Prof. KERRY.—You were on the bridge when the traveller was moved out?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And you examined the chord after it was moved out?

Mr. MCLURE.—Yes, sir, without measuring it.

Prof. KERRY.—Without noticing any alterations?

Mr. MCLURE.—Not much.

Prof. KERRY.—Without measurement?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And you left the bridge when?

Mr. MCLURE.—I left at 12.30 on Wednesday.

Prof. KERRY.—Was the traveller then fully out?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Your letter would have reached New York about when?

Mr. MCLURE.—Reached there the same time I did.

Prof. KERRY.—You wrote it on Tuesday?

Mr. MCLURE.—It was mailed Tuesday evening, and I do not know what time it

reached the city, but Mr. Cooper would have received it and read it when he came to the office on Thursday morning, which he did.

Prof. KERRY.—Was Mr. Yenser's action in moving out the traveller reported to Mr. Hoare or Mr. Cooper?

Mr. McLURE.—Well, not in that letter, because that was before he moved the traveller.

Prof. KERRY.—I mean you did not wire to Mr. Cooper that that action had been taken previous to your leaving Quebec?

Mr. McLURE.—No, sir.

Prof. KERRY.—Did you telephone to Mr. Hoare about it?

Mr. McLURE.—Mr. Hoare was on his way out to the bridge.

Prof. KERRY.—Mr. Hoare was on his way to the bridge, so that he saw when he came out—at what time did he arrive?

Mr. McLURE.—About eleven o'clock, I think, on Wednesday.

Prof. KERRY.—You drew his attention, when he came out, to the fact that the traveller had been removed?

Mr. McLURE.—Yes, sir.

Prof. KERRY.—Did you discuss at that time whether it was necessary to take any action of that sort in regard to the safety of the bridge?

Mr. McLURE.—Nobody had any idea that the safety of the bridge was in danger.

Prof. KERRY.—So that the matter was not discussed?

Mr. McLURE.—Not discussed in that light.

Prof. KERRY.—You are clear on that, Mr. McLure? You mean that it never occurred to any one that the safety of the bridge was threatened?

Mr. McLURE.—No, sir.

Prof. KERRY.—And that any drastic action to protect the bridge was therefore not thought about?

Mr. McLURE.—That is the idea.

Prof. KERRY.—You went over the bridge with Mr. Hoare?

Mr. McLURE.—No, I did not. I left too soon for New York and Phœnixville.

Prof. KERRY.—You left to go down to New York and you did not accompany Mr. Hoare on his examination of the bridge?

Mr. McLURE.—No, sir.

Prof. KERRY.—And between Tuesday morning and the time you left no accurate measurements were made to see whether that deflection was increasing?

Mr. McLURE.—No, sir, no actual measurements.

Prof. KERRY.—Then what followed, in your own personal experience, Mr. McLure, after you left the bridge?

Mr. McLURE.—I got to New York next morning at 7.30.

Prof. KERRY.—That would be Thursday morning?

Mr. McLURE.—Thursday morning—went down to Mr. Cooper's office and saw Mr. Berger. Mr. Cooper did not get in till 11.15, and so I had to wait and see him. As soon as he came in he found my letter waiting for him, and he read it and I went in to see him. I also had my notes and sketches with me and explained the matter to him.

Prof. KERRY.—Are these notes and sketches in evidence?

Mr. McLURE.—This sketch you have (sketch marked exhibit No. 41) I showed to Mr. Cooper.

Prof. KERRY.—And?

Mr. McLURE.—We talked the matter over; I explained to him any points he was not clear on and he told me to go to Phœnixville.

Prof. KERRY.—It was a thorough discussion, Mr. McLure?

Mr. McLURE.—I do not remember just what was said.

Prof. KERRY.—How long were you talking over the matter?

Mr. McLURE. Not more than 45 minutes.

Prof. KERRY.—You drew Mr. Cooper's attention then to the fact that the traveller had been moved forward since?

Mr. MCLURE.—Yes.

Prof. KERRY.—And to the fact that no further measurement of the deflections had been made?

Mr. MCLURE.—Yes, sir. I also told him that as far as we could see by eye no further change was noticed in the chord since the moving of the traveller. I told him that it was my understanding when I left the bridge that there would be no more metal erected until advices were received regarding these chords. That was my understanding with Mr. Yenser. I asked him whether, in his opinion, it would be all right to go ahead with the erection with the chords in that condition, and he sat down and wrote a telegram to the Phœnixville Bridge Company.

Prof. KERRY.—He did not answer you directly?

Mr. MCLURE.—No, I do not think he answered me.

Prof. KERRY.—You are not personally aware of the wording of the telegram?

Mr. MCLURE.—Not of the exact words—no.

Prof. KERRY.—Did he tell you what the effect of the telegram was?

Mr. MCLURE.—He showed it to me.

Prof. KERRY.—And it said practically what?

Mr. MCLURE.—Don't add any more weight to the bridge until the facts are carefully considered, or something to that effect; I cannot remember if these are the exact words. Mr. McLure will arrive five o'clock—I think he added to it.

Prof. GALBRAITH.—What was that you said?

Mr. MCLURE.—Mr. McLure will arrive at five o'clock.

Prof. GALBRAITH.—Where?

Mr. MCLURE.—Phœnixville.

Prof. GALBRAITH.—He was telegraphing to the Phœnix Bridge Company?

Mr. MCLURE.—The Phœnix Bridge Company.

Prof. KERRY.—The facts would be, Mr. McLure, that at noon on Tuesday Mr. Yenser stated that he would not increase the load on the bridge by moving the traveller forward?

Mr. MCLURE.—In the afternoon it was.

Prof. KERRY.—In the afternoon of Tuesday?

Mr. MCLURE.—Yes.

Prof. KERRY.—That on Wednesday morning, without further consultation with you, he commenced to move the traveller out?

Mr. MCLURE.—I asked him his reason and he said that he had too many men out.

Prof. KERRY.—Practically moved the traveller out to find work——

Mr. MCLURE.—For the number of men he had out.

Prof. KERRY.—That was his reason for it?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And that you advised him at the time——

Mr. MCLURE.—That I thought it was poor policy.

Prof. KERRY.—But at the same time you did not consider that it was dangerously increasing the strain on the member?

Mr. MCLURE.—I do not think I told him that.

Prof. KERRY.—But you agreed to that with Mr. Birks?

Mr. MCLURE.—I had that in my mind.

Prof. KERRY.—You and Mr. Birks had looked into that and that was your joint conclusion?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And that when you reached Mr. Cooper and gave him the facts he immediately wired to cease increasing the load on the members?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Then what followed? You left for Phœnixville?

Mr. McLURE.—Yes, I got to Phœnixville about five o'clock, went to the office of the Bridge Company and had a talk with Mr. Deans about these chords. I forgot to mention that when I was in Mr. Cooper's office I got a telegram from Mr. Birks—that was about half-past ten o'clock on Thursday morning—saying that—I have the telegram here—do you want to see it ?

Prof. KERRY.—It would be as well to read it.

Mr. McLURE.—(reading): 'I do not think we can state positively that chord has buckled since erection ; the only definite evidence we have shows the contrary. See my letter with additional data in Phœnixville to-morrow morning. Signed A. H. Birks.'

Prof. GALBRAITH.—At what hour was that telegram sent from here ?

Mr. McLURE.—It has 9.45 on it.

Mr. HOLGATE.—That is the receipt in New York.

Prof. KERRY.—When you said to Mr. Yenser that it was poor policy to move the traveller forward you were not thinking at the time of the safety of the bridge but of the difficulty of making the necessary repairs ?

Mr. McLURE.—That is what I had in mind—the difficulty of making repairs under the increased stress.

Prof. KERRY.—Referring to Mr. Birks' telegram, he mentions positive evidence there. Did you see that evidence ?

Mr. McLURE.—I have not seen any evidence yet that I consider positive.

Prof. KERRY.—Did you see the letter ?

Mr. McLURE.—I think Mr. Deans showed me the letter.

Prof. KERRY.—What information was there bearing on this chord ?

Mr. McLURE.—He stated his reasons why he thought it was possible that the bend might have been there longer than we thought it had.

Prof. KERRY.—But without anything absolute in the way of measurements ?

Mr. McLURE.—Yes, without anything absolute in the way of measurements.

Prof. KERRY.—What followed in your discussion ?

Mr. McLURE.—I showed that telegram to Mr. Cooper when I was in New York, and when I got to Phœnixville Mr. Deans and I talked it over. He said that he had a telephone message from Mr. Birks, I think, stating that it was his opinion that the bends in the A-9-L chord were not of recent occurrence, that he was writing a letter explaining the matter and had written a letter explaining the matter which they would receive the following morning. Mr. Deans seemed also to think that the bends had probably been in the chord, if not since it was turned out of the shop, they were there for some time.

Prof. KERRY.—Did he offer you any definite evidence of the fact ?

Mr. McLURE.—Nothing, except that he said, I think if you would measure some chords at Belair you would find similar bends.

Prof. KERRY.—Was there anything further in your conversation?

Mr. McLURE.—No, we did not bring it to any definite close on account of our desire to wait for Mr. Birks' letter to see what he had to say about the reasons for not thinking that the bends were of recent occurrence; so that we agreed to meet the following morning when Mr. Birks' letter would be there and talk the matter over further.

Prof. KERRY.—Then what followed?

Mr. McLURE.—I left the office at about six o'clock, and I heard of the collapse of the bridge about 7.30.

Prof. KERRY.—How did that word reach you?

Mr. McLURE.—It reached me by someone telling me that someone had telephoned to them that the bridge had fallen down.

Prof. KERRY.—It was indirect?

Mr. McLURE.—Indirect, yes.

Prof. KERRY.—Did you make any further investigation into the history of that chord while you were still in Phœnixville?

Mr. MCLURE.—No, I left early the next morning.

Prof. KERRY.—Simply came straight through to Quebec?

Mr. MCLURE.—Came right back.

Mr. STUART.—Will you ask him whether he brought any other instructions to Phœnixville—to Mr. Deans—than were contained in the telegram which Mr. Cooper had sent.

Prof. KERRY.—Did you have any verbal instructions at all to the Phœnix Bridge Company?

Mr. MCLURE.—Mr. Cooper told me to go to Phœnixville, see Mr. Deans and tell him that some steps must be taken to strengthen that chord—I think he said—or to repair the chord, and I do not think I told him that that evening at Phœnixville.

Prof. KERRY.—Mr. Cooper's telegram had already been received when you reached Phœnixville?

Mr. MCLURE.—Yes, I think Mr. Deans said that he had had a telegram from Mr. Cooper when I reached there.

Mr. STUART.—I thought Mr. McLure said that he showed Mr. Birks' telegram to Mr. Deans.

Mr. MCLURE.—Showed it to Mr. Cooper. I do not know whether I showed it to Mr. Deans or not; maybe I did.

Mr. STUART.—At that time Mr. Birks' letter to Mr. Deans had not been received. It was only received on the following morning, and they decided to wait until they received that letter.

Prof. KERRY.—That is what Mr. McLure says in his evidence.

Mr. STUART.—Much of it I miss because he speaks so low.

Prof. KERRY.—Have you heard anything further from Mr. Cooper since your interview with him in New York?

Mr. MCLURE.—I stopped to see him on my way back here.

Prof. KERRY.—Did you see him at that time?

Mr. MCLURE.—Yes, sir.

Pro. KERRY.—Did he express any opinion at all?

Mr. MCLURE.—He said: 'Well, it's that chord.' I only saw him a few minutes; he was not feeling very good.

(In confirmation and explanation of previous statement the witness identified Exhibit No. 41 as correctly showing the measurements made on the morning of Tuesday, August 27, of chord No. 9-L of the anchor arm and chords Nos. 8-R and 9-R of the cantilever arm.)

Prof. KERRY.—Is that correct, Mr. McLure?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—At the time that these measurements were made, Mr. McLure, were the opposite chords in each case examined?

Mr. MCLURE.—Not by me.

Prof. KERRY.—You just went over these three chords?

Mr. MCLURE.—Yes.

Prof. KERRY.—Practically, in the whole system of inspection, Mr. McLure, there was no means of definitely ascertaining whether these chords were straight or what their deflection from the straight was when they were placed in the bridge? They had not been measured for true, and there was no record of their shop deflections?

Mr. MCLURE.—I think not.

Prof. KERRY.—So that any discussion in regard to the time that that deflection took place would be a matter of opinion?

Mr. MCLURE.—Well, we knew that every piece, particularly every main member that went into the bridge, had been inspected for just such things as bends in the ribs. We also knew that nothing as large as the bends we had measured, particularly

in the A-9-L chord, could possibly have escaped an inspection such as we gave that member.

Prof. KERRY.—My recollection of previous evidence is that you and Mr. Birks together made the final inspection of each member before it was put in.

Mr. MCLURE.—Mr. Kinloch made the same inspection, too.

Prof. KERRY.—The inspection on the car previous to the hoisting of the member was made by whom?

Mr. MCLURE.—Mr. Kinloch and myself, and Mr. Birks, usually. Mr. Birks paid particular attention to the attachment of the attachments.

Prof. KERRY.—You and Mr. Kinloch paid particular attention to the member itself?

Mr. MCLURE.—Yes.

Prof. KERRY.—You are absolutely convinced that you would not have passed a member with any such deflection upon it?

Mr. MCLURE.—Yes. Of course, I was not here when A-9-L chord was erected. Mr. Kinloch was.

Prof. KERRY (to Mr. Kinloch).—Previous to Mr. McLure coming here did that system of inspecting members on the car before they were placed in position exist?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—So that chord 9-L would have been inspected by you previous to unloading from the cars to the traveller?

Mr. KINLOCH.—Yes, sir, and it was also free from any upright members for five or six months, and any one walking over it could have seen it.

Prof. KERRY (to Mr. McLure).—Had you made, for any reason, any definite observation of the condition of the chord previous to the time of the measurement of the chord as shown in Exhibit No. 41?

Mr. MCLURE.—Yes, sir, of A-9-L; two or three days before I went to the hospital, the dates of which I have given already, I sighted along each rib of the chord, particularly the rib that had the mark of the chain on, as described by Mr. Kinloch yesterday, to see if there were any bends noticeable, but particularly to see how the bend made by that chain was acting under load and, from my observation then, I am convinced that the ribs were straight.

Prof. KERRY.—That is to say within a deflection of——?

Mr. MCLURE.—Within two or three weeks of the accident.

Prof. KERRY.—They were straight to within what wind?

Mr. MCLURE.—To within at least half an inch.

Prof. KERRY.—The condition and the progress of the work at that time would be fully recorded; more particularly, I suppose, this would be fully recorded in Mr. Yenser's reports, would it not?

Mr. MCLURE.—At the date of the accident?

Prof. KERRY.—At the date of your previous inspection—the position of the cantilever and the number of pieces up at that time?

Mr. MCLURE.—Yes, sir. You could get it either from Mr. Yenser's reports or from my books.

Prof. KERRY.—Your books would show just when each member was raised and when the traveller was moved?

Mr. MCLURE.—I have a book that shows the date that each member was raised.

Prof. KERRY. Have you a copy of that book with you?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—You might file that also, please.

Mr. MCLURE.—I could shorten that up by reading it out of my diary.

Prof. GALBRAITH.—You might do that.

Prof. KERRY.—Do you want to make a statement from that?

Mr. MCLURE.—From this book?

Prof. KERRY.—Yes?

Mr. McLURE.—Just as it suits you. That will be the shortest way, I think. You want the condition of the erection at the time I made an inspection of the chord and found it straight. As nearly as I remember the date was August 15. At that time I have recorded as being erected on that day the bottom chord sections of the suspended span B-R and L of sub-diagonals S-P-2-R and L. These chords were connected by pinning diagonal eye-bars T-2-P and L to the hangers T-O-O. That was on the third panel of the suspended span. The main post of the small traveller then would be over post P-1 of the suspended span and I should say the panel was approximately half erected—panel 3.

Prof. KERRY.—The traveller was sitting on the second panel?

Mr. McLURE.—Yes. The tip of the top forward overhang only had been removed.

Commission took recess.

AFTERNOON SESSION—TWELFTH DAY.

The Commission resumed at 2 p.m.

Mr. HOARE put in monthly progress estimates from June, 1904, to July, 1907, accompanied by progress diagrams (filed and marked Exhibit No. 42).

Mr. McLURE, recalled.

Prof. KERRY.—You were familiar with the instructions issued by the Phœnix Bridge Company in regard to erection, Mr. McLure?

Mr. McLURE.—Yes, sir.

Prof. KERRY.—And in all except very minor detail those instructions were absolutely followed?

Mr. McLURE.—Yes.

Prof. KERRY.—In particular were the instructions in regard to the opening at the joints between the several chords of the lower chord followed exactly?

Mr. McLURE.—They could not follow any instructions in regard to the openings. They had to make their own openings. You could not make the openings anything you wanted to.

Prof. KERRY.—Not setting the place originally?

Mr. McLURE.—You could on the anchor arm. On the anchor arm the opening centres are set to a certain elevation. On the cantilever arm the opening in the chord would be made at a certain point and you could not change that if you wanted to.

Prof. KERRY.—You mean that the length of the members absolutely fixed that opening?

Mr. McLURE.—Yes, sir.

Prof. KERRY.—And as it worked out the openings were as anticipated?

Mr. McLURE.—The openings agreed fairly well with what was supposed.

Prof. KERRY.—What do you mean by fairly well?

Mr. McLURE.—They were not always exactly what was indicated on the drawing.

Prof. KERRY.—How much would they vary?

Mr. McLURE.—An eighth of an inch.

Prof. KERRY.—I think you told us that you were not present at the time that the lower chord of the anchor arm was laid?

Mr. McLURE.—No, sir.

Prof. KERRY.—So that you could give us no positive evidence in regard to those openings?

Mr. McLURE.—I know what they were after I got there.

Prof. KERRY.—Was it possible to examine them ?

Mr. MCLURE.—Yes.

Prof. KERRY.—And they were in accordance with the blue print instructions ?

Mr. MCLURE.—I do not remember whether they were or not. My impression is they were.

Prof. KERRY.—They were sufficiently in accordance that you had no ground for taking any exception ?

Mr. MCLURE.—Yes.

Prof. KERRY.—What opportunity had you to observe these openings during the building out of the cantilever arm ?

Mr. MCLURE.—The observations we made on the outstanding legs of the top and bottom flange angles of the two outside ribs.

Prof. KERRY.—They were regularly measured ?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—How often was that done ?

Mr. MCLURE.—Every time the traveller was moved, or in other words, every time a panel of the cantilever arm was completed.

Prof. KERRY.—Do you have a record of these movements ?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—(to Mr. Deans).—Will these also be recorded on that general diagram you showed us, Mr. Deans?

Mr. DEANS.—No, they will not be recorded on that, but there are other reports including these openings you have referred to now.

Prof. KERRY.—In Mr. Yenser's file ?

Mr. DEANS.—Mr. Cudworth said that he made a set of those that will be filed.

Mr. MCLURE.—I have them here.

Prof. KERRY.—Have you got them in shape to file ?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—You better put them in as an exhibit, please. (Diagrams produced.)

Mr. HOLGATE.—How do you describe these, Mr. McLure ?

Mr. MCLURE.—Diagrams showing changes in openings of bottom chord splice. (Put in and market Exhibit No. 43.)

Prof. KERRY.—In general the closing up of these so-called camber openings was regular and satisfactory ?

Mr. MCLURE.—Yes, sir, it was in general.

Prof. KERRY.—We asked Mr. Milliken at the time he was giving his evidence for a diagram showing the exact condition of the riveting at the time of the failure. Has that yet been prepared, do you know ?

Mr. MCLURE.—No, I have not heard Mr. Milliken say anything about it yet.

Mr. DEANS.—I do not think that has been prepared as yet, but we will see that it is prepared. He will have to confer with Mr. Kinloch about that.

Prof. KERRY.—The riveting of the main connections, Mr. McLure, was dependent on the closing up of the joints ?

Mr. MCLURE.—Riveting of the splices ?

Prof. KERRY.—Yes?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Was there any material delay between the time that a splice was ready for riveting and the time that the riveting was actually done?

Mr. MCLURE.—I do not know that you would call it delay. None of them were riveted until they got ready to rivet them whether they were closed or not.

Prof. KERRY.—You had no reason to make any complaint as to the force of riveters actually at work on the bridge?

Mr. MCLURE.—None at all.

Prof. KERRY.—It was all that the Quebec Bridge Company desired in that respect?

Mr. McLURE.—Yes, sir.

Prof. KERRY.—Have you any record of the removal of the false work from under the anchor arm—the dates?

Mr. McLURE.—I have a separate record. It would be included in my diary, or my correspondence with Mr. Cooper, stating the condition at each time that a report was made.

Prof. KERRY.—As I remember the previous evidence, no false work was removed until the anchor arm was entirely free from it.

Mr. McLURE.—There were definite instructions issued from Phœnixville regarding the removal of false works, and as I remember Mr. Cooper knew of these instructions and approved of them.

Prof. KERRY.—These instructions were regularly and closely followed?

Mr. McLURE.—Yes, sir, I think they were right to the letter.

Prof. KERRY.—So that the record of instructions from the Phœnixville office will fully cover the removal of the false work?

Mr. McLURE.—I think it was not removed quite as soon as it could have been according to those instructions; that is some parts were left under a little longer than they need to have been according to the instructions.

Prof. KERRY.—Had you any chance to, or did you observe any relation between the movements of the cantilever forward and the closing of the joints along on the chord?

Mr. McLURE.—Yes, sir.

Prof. KERRY.—Was there a definite and observable relation or was it little marked?

Mr. McLURE.—There was a uniform movement forward of the top of the main post, and at the same time apparently there was a closing of the joints of the anchor arm.

Prof. KERRY.—Was that to such an extent that you could fairly predict when the cantilever moved forward what the result of your measurements would be?

Mr. McLURE.—Not as regards each particular splice. When the cantilever arm was pretty well out on the main pier you could count on finding much smaller openings in the anchor arm joints each time the traveller was moved than you could count on at the top of the centre post each time the traveller was moved as compared with the previous measurement.

Prof. KERRY.—The moving of the parts under the altered stress due to the advance of the traveller, that would be almost immediate, Mr. McLure?

Mr. McLURE.—No, sir.

Prof. KERRY.—It did not take any length of time to settle into position?

Mr. McLURE.—I should say it would take at least twenty-four hours.

Prof. KERRY.—You usually made measurements how long after the traveller was moved?

Mr. McLURE.—Usually not until the next day; I gave it time to work out through the truss.

Prof. KERRY.—So that the members would get their set before you made your measurement?

Mr. McLURE.—Yes.

Prof. KERRY.—At what time during the erection did the upper chord commence to come into play?

Mr. McLURE.—During the erection of the third panel of the south cantilever arm.

Prof. KERRY.—The minute the strain came on it of course it would be in every panel——

Mr. McLURE.—Right straight back through to the end of the anchor arm.

Prof. KERRY.—And you found that the several bars were acting together?

Mr. McLURE.—Yes, I found that right straight through the work.

Prof. KERRY.—That is to say they were so accurately made that when the stress came on a composite member all parts commenced to act immediately.

Mr. McLURE.—All parts seemed to act together.

Prof. GALBRAITH.—How did you test that?

Mr. McLURE.—By kicking them.

Prof. GALBRAITH.—By sound?

Mr. McLURE.—Not by sound, by motion.

Prof. GALBRAITH.—In your discussion with Mr. Birks previous to the last movement of the traveller, did he express any definite opinion?

Mr. McLURE.—I do not know that he expressed a definite opinion, but he gave me the impression that he did not think it would make much difference whether the traveller was moved or not.

Mr. STUART.—I think Mr. McLure shared that view himself?

Prof. KERRY.—Mr. McLure stated that this morning. (To Mr. McLure): To what extent, when you were going through these figures yourself, Mr. McLure, did you consider the very peculiar action of a post member in the way of the stress? You were considering the deflection of a heavy compression member. You estimated the increase of the stress due to the movement forward of the cantilever arm. Did you make any other calculations?

Mr. McLURE.—We would figure the stress in the latticing, due to the eccentricity that we measured in that chord.

Prof. KERRY.—In the ordinary chord member, normal and straight, did you have occasion to examine the latticing at all? Not in any special chord, but in any one of the chords that was under full strain?

Mr. McLURE.—No, I think not.

Prof. KERRY.—You are not in a position to say whether the latticed members, particularly the 'X' members, would be very tight or not, under very heavy strain?

Mr. McLURE.—On an ordinary chord?

Prof. KERRY.—An ordinary chord, yes?

Mr. McLURE.—No, sir.

Prof. KERRY.—In the case of the chords you examined, what was the condition of these bars?

Mr. McLURE.—They were absolutely straight, there were no loose rivets with one exception, and upon rapping a few of them they gave forth a kind of singing sound, like a wire under tight strain.

Prof. KERRY.—In other words, you thought they were under heavy strain?

Mr. McLURE.—They seemed to be working; how heavy you could not tell.

Prof. KERRY.—And what was your calculation directed to find out? You speak about calculating the stress in the latticing due to the deflection; did you consider that latticed member as a truss that was deflected down a matter of two inches in that length?

Mr. McLURE.—Yes, we made the assumption that the deflection was a maximum through all the ribs, that the latticing acted as a truss with freedom to move the joints, and that the ribs had no stiffness in themselves.

Prof. GALBRAITH.—You calculated as if the whole chord was bent into a circle?

Mr. McLURE.—No.

Prof. GALBRAITH.—And calculated the shearing force taken up by the latticing?

Mr. McLURE.—Yes. I think we found the latticing was strained considerably under one-half the elastic limit. I do not remember the figures exactly according to our assumptions.

Prof. KERRY.—You would assume in that calculation that the normal chord member had no stress in the latticing at all?

Mr. McLURE.—No initial stress.

Prof. KERRY.—No initial stress of any kind? You would have calculated those stresses in the lacing or latticing simply from the elongation of the members necessary to give a circular form?

Mr. McLURE.—Yes.

Prof. KERRY.—That was practically all that you had to go on?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Did you include in that calculation the fact that the length along the chord in the rib between the two ends of the lattice bar had been materially decreased by the shortening of the member?

Mr. MCLURE.—By the shortening due to strain?

Prof. KERRY.—Due to the compression of the member?

Mr. MCLURE.—Compressive stress, no.

Prof. KERRY.—Normally it would appear that with a member perfectly straight on account of that compression the latticing would not be under strain, it might even be under a slight compression strain?

Mr. MCLURE.—Due to the shortening of the member. That shortening was about three-eighths of an inch in the whole length of the chord under its full strain. Of course it was only receiving about two-thirds, therefore it would not be that much.

Prof. KERRY.—That theoretical consideration was not covered?

Mr. MCLURE.—It was not entered into.

Prof. KERRY.—And did you make any effort to apply the various theories of post flexure to the conditions existing?

Mr. MCLURE.—From which the different column formulæ were derived?

Prof. KERRY.—Yes?

Mr. MCLURE.—No, sir, that did not enter into this, because the cross sections were such that we did not have to use a column formula to reduce the stress.

Prof. GALBRAITH.—You say you found by hammering the lacing that it was under high tension? How did you compare the sound of the diagonal latticed members at the places where the bulge was greatest? We will say the centre of the post and the diagonal lattice members at the end, did you compare the sound of those two members?

Mr. MCLURE.—No, I did not. Mr. Kinloch did the hammering, and as I remember it, he hammered half a dozen all in the same neighbourhood.

Prof. KERRY (to Mr. Kinloch).—Was there any difference in the sound of a diagonal member near the middle of the chord and near the end of the chord?

Mr. KINLOCH.—There was some slight difference, yes.

Prof. KERRY.—Which way?

Mr. KINLOCH.—I do not remember now; they all sounded high.

Prof. KERRY.—You could not distinguish to say which was lowest and which was highest?

Mr. KINLOCH.—I do not remember now.

Prof. KERRY.—In general, the condition of the latticing on the different chords was entirely satisfactory?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—You assumed in your calculations that you were dealing with what is technically known as a short column all the time?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And you did not realize that the moment the member showed an appreciable deflection it showed that it was not a short column?

Mr. MCLURE.—I am not convinced of that yet.

Prof. KERRY.—You are not convinced of that yet?

Mr. MCLURE.—No, sir.

Prof. KERRY.—Have you any other information you would like to add, Mr. McLure, anything that you think would be of assistance to the Commission in drawing its attention to the cause of failure, the cause and the locality?

Mr. MCLURE.—I do not think of anything just now.

Prof. KERRY.—You are satisfied by the measurements you have taken both before and since the accident that the cause of the failure lies entirely in the steel work?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—That the foundations are in perfect condition and have not moved to an appreciable extent?

Mr. MCLURE.—They have got copings chipped off, otherwise they are in perfect condition.

Prof. KERRY.—And without any appreciable shift?

Mr. MCLURE.—Yes, sir, the main pier seems to have risen a little bit.

Prof. KERRY.—I shall ask you further questions on that when Mr. Cudworth submits the diagrams and measurements. On a strictly technical point, would the appearance of those columns and the flexure in the columns as you looked at them, particularly in the neighbourhood of the joints, suggest that the columns had free ends or fixed ends?

Mr. MCLURE.—Which one, the cantilever arm or the anchor arm?

Prof. KERRY.—Both?

Mr. MCLURE.—I think the anchor arm chord from appearances would give the impression of a column with free ends; the cantilever arm chords look more like a column deflected with fixed ends. (This answer is modified by a subsequent answer.)

Prof. KERRY.—That is to say, in the case of the anchor arm the fracture apparently extended right down the whole splice?

Mr. MCLURE.—Yes.

Prof. KERRY.—But on the cantilever arm?

Mr. MCLURE.—It seemed to run out.

Prof. KERRY.—It ran out to the edge of the cover plate?

Mr. MCLURE.—Yes.

Mr. STUART.—You might ask him how he accounts for that?

Prof. KERRY.—Can you advance any reason or suggest any reason for the difference of apparent action in the two cases?

Mr. MCLURE.—I do not know why there should be any difference in the action; no, the splices are almost identical.

Prof. KERRY.—And they were not fully riveted up in either case, were they?

Mr. MCLURE.—Yes, the anchor arm chord was fully riveted at one end and the other end ran into the next panel. It was not riveted, so that the deflection that I had in mind was in that part of the No. 9 anchor arm chord lying south of the T-5-Z hanger.

Prof. GALBRAITH.—The splice was on the other side?

Mr. MCLURE.—One splice, the splice that was not riveted.

Prof. GALBRAITH.—You mean the splice that was really at the other end of the chord?

Mr. MCLURE.—Yes.

Prof. KERRY.—In the other case, on the cantilever arm?

Mr. MCLURE.—On the cantilever arm, the splice between 10 and 9 was riveted, and I think between 9 and 8 fully riveted; between 8 and 7 was being riveted.

Prof. KERRY.—In the plans filed under No. 43, showing the openings at the chord joints, what was the accuracy of measurement, to what unit were they measured?

Mr. MCLURE.—One sixty-fourth of an inch either way; that is a possible total variation of 1/32 of an inch.

Prof. KERRY.—The possible error in the figures as given there you would place at 1/32 of an inch?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Do you know if any of those joints were found to be open to that extent when the cover plates were removed?

Mr. MCLURE.—The cover plates were never removed until the joints were tight.

Prof. KERRY.—How would you know they were tight if the measurements were not closer than 1/32 of an inch?

Mr. MCLURE.—I stuck a 1/64 inch plate in them if they were open; if you could not get it in they were tight.

Prof. KERRY.—Could you get into the joint?

Mr. MCLURE.—You could get to the outstanding edge of the flange angles.

Prof. KERRY.—The lower flange angles?

Mr. MCLURE.—Lower or upper, as the case might be.

Prof. KERRY.—And the entire end of the chord member was cut to a true plane?

Mr. MCLURE.—Yes, faced off on a rotary machine.

Prof. GALBRAITH (after a conversation with Mr. McLure).—I think Mr. McLure might say: 'On reconsideration of my answer respecting the free endedness or otherwise of the columns, I am inclined to think that since I have had an opportunity of observing the bend only from batten plate to batten plate the chord as a whole could not be necessarily considered free-ended at the end next post T-5-Z hanger.' That is what you mean, is it not?

Mr. MCLURE.—Yes.

Prof. KERRY.—Under the direction of the Commission, Mr. McLure, you have made certain surveys of the wreck, have you not?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Have plans from those surveys been prepared?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—Are they ready for deposit?

Mr. MCLURE.—Yes. Do you want everything, levels and lines?

Prof. KERRY.—Just make a deposit of each one and we will say what it is.

(Document produced, filed and marked Exhibit No. 44.)

Prof. KERRY.—Exhibit 44 was submitted to show the positions of the top chord panel points in plan before and after the accident, the positions after the accident being indicated by full circles.

(Document produced, filed and marked Exhibit No. 45.)

Prof. KERRY.—Exhibit 45 shows similar information concerning the bottom chord panel points and the positions before and after the accident are marked by the same method.

(Document produced filed and marked Exhibit No. 46.)

Prof. KERRY.—Exhibit 46 shows the positions in side elevation of the panel points of both the upper and the lower chord of the east truss of the anchor arm before and after the accident, the elevations of the panel points after the accident not being accurately fixed.

(Document produced, filed and marked Exhibit 47.)

Prof. KERRY.—Exhibit No. 47 gives the same information with regard to the west truss of the anchor arm.

(Document produced, filed and marked Exhibit No. 48.)

Prof. KERRY.—Exhibit No. 48 shows the results of measurements made to determine whether any horizontal movement had taken place between the anchor pier and the main pier on the south side.

(Document produced, filed and marked Exhibit 49.)

Prof. KERRY.—Exhibit 49 shows the position before and after the accident of the pedestals on the main pier.

(Document produced, filed and marked Exhibit No. 50.)

Prof. KERRY.—Exhibit 50 shows the elevations determined at various dates of two bench marks on the face of the main pier.

Prof. KERRY.—How many of the elevations given in exhibit 50 were determined by yourself, Mr. McLure?

Mr. MCLURE.—I had a hand in all of them.

Prof. KERRY.—You assisted in all of them?

Mr. MCLURE.—Yes, I think.

Prof. KERRY.—And the one especially marked with your initials?

Mr. MCLURE.—I took as a check.

Prof. KERRY.—A special check measurement that you made independently.

Mr. MCLURE.—Yes.

Prof. KERRY.—Now, you might state any observations of interest that you made on the wreck, Mr. McLure, any points that you observed which you think bear directly on the cause of the disaster, or would indicate the position of the first break. You assisted, I believe, at the taking of the photographs that were submitted yesterday by Mr. Kinloch and in the identification of the parts both on the ground and on some of the photographs?

Mr. MCLURE.—Yes.

Prof. KERRY.—And to the best of your knowledge those are perfectly correct?

Mr. MCLURE.—Yes, with the exception of the corrections Mr. Kinloch made yesterday.

Prof. KERRY.—That has been made on the photograph.

Mr. HOLGATE.—Yes.

Mr. MCLURE.—Not on the negative; I made it on your copy.

Prof. KERRY.—Would you tell the results of your observations?

Mr. MCLURE.—The tension members all seemed to be in pretty good shape, only one eye-bar broken as far as I could see.

Prof. KERRY.—Was there anything in the tension members to indicate that they fell before the general fall?

Mr. MCLURE.—No, nothing to indicate that they would fall; also nothing to indicate that they had been in any way over-strained except during the fall. The details of all the connections, both pin and riveted, as far as I have observed, are, with one or two exceptions, in as good condition now as before the accident. These exceptions are minor points in a few ears in the pin connection, and in general the connections are intact.

Prof. KERRY.—You have noticed nothing in those connections to indicate a failure previous to the collapse?

Mr. MCLURE.—No, sir. The condition of the transverse bracing, of course, is pretty bad, pretty well smashed up, also the lateral system and the floor system, although there are certain panels in the floor system that seem to have escaped without much damage. In the main compression members is noticed the greatest damage due to the fall. In the vertical posts there is evidence in almost every case of almost complete destruction of certain parts, particularly in the body of the member. In the bottom chords there is also evidence of destruction in numerous places. I guess that about covers all of them.

Prof. KERRY.—You arranged to submit an additional plan showing the position of the floor beams? We understand that the floor beams in every case in the anchor arm were riveted before the accident took place?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—You were to submit a plan showing the position of the floor beams before and after the accident, determining on the ground the position of the two ends of each floor beam, or in one or two cases where the floor beam was badly bent, possibly to determine the two ends and the centre.

Mr. MCLURE.—In the case of the truss floor beam to take the ends of the top chord on which the stringers rested?

Prof. KERRY.—Yes. What we particularly wish to determine from that is to see if we can make out how those floor beams fell. It is fair to assume, I think, that the the floor beam remained connected with the post until the post struck the ground.

Mr. MCLURE.—I think probably you will find most of them lying right between their connections now. I can find that out definitely.

Prof. KERRY.—Have you seen any members among the wreckage that you consider may have fallen previous to the general collapse?

Mr. MCLURE.—Judging from their present condition?

Prof. KERRY.—Judging entirely from their present condition?

Mr. MCLURE.—The main posts look very much as though they might have fallen any time either before or during the collapse from their positions now. Judging entirely from their present conditions, I should think that any one of the vertical posts might have fallen.

Prof. KERRY.—That is to say, they are so completely broken up?

Mr. MCLURE.—That they might have fallen before the collapse, yes.

Prof. KERRY.—Might have fallen at any time and you would not have been able—

Mr. MCLURE.—To tell which fell first. Also chords 9-R and L of the anchor arm might have fallen before the collapse.

Prof. KERRY.—Do you think it likely that if any chords of the anchor arm fell that those chords show more indication of failure than any of the others?

Mr. MCLURE.—They are more completely demolished now than any of the other chords. They either fell first, if any of the chords did, or else they got the worst treatment in the fall.

Prof. KERRY.—From your observation, Mr. McLure, is it your opinion that the failure took place in the top chord?

Mr. MCLURE.—No, sir.

Prof. KERRY.—Is it your opinion that it took place in the posts?

Mr. MCLURE.—I have not any opinion that is not subject to change, but at the present time it is not.

Prof. KERRY.—Is it your opinion that it took place in any of the lateral or bracing systems?

Mr. MCLURE.—No, sir.

Prof. KERRY.—Then it is your opinion that the failure took place in the bottom chord?

Mr. MCLURE.—Yes, sir.

Prof. KERRY.—And from the present condition of the wreckage you consider it probable that it took place, more likely than any other hypothesis that can be advanced, in chords 9-L and 9-R?

Mr. MCLURE.—Yes, sir, one or the other first, I do not know which.

Mr. STUART.—Would you mind asking Mr. McLure whether there was anything which indicated that there was a failure in any part of the cantilever arm first?

Prof. KERRY.—Have you seen or heard any evidence that would indicate that the failure occurred in any part of the cantilever arm?

Mr. MCLURE.—I did not see it fall.

Prof. KERRY.—You have seen nothing since the accident?

Mr. MCLURE.—I have seen nothing since to indicate that there was any failure in the cantilever arm.

Prof. KERRY.—Have you heard any one who saw the bridge fall claim to have seen the failure at any point in the cantilever arm?

Mr. MCLURE.—I have heard so many stories now I cannot recollect; they are all different. I do not think I have.

Prof. KERRY.—Will you read over this description, Mr. McLure? (handing witness typewritten paper). Can you say that that description which was prepared by Mr. Cudworth from the dictation of members of the Commission correctly describes the present position of chords 9-A-L and 9-A-R?

Mr. MCLURE.—It describes the position of 9-A-R. It seems to describe mostly the position of the chain mark and loose rivet on 9-A-L.

Prof. KERRY.—You think it should be amplified to state the full position of 9-A-L?

Mr. MCLURE.—Yes; I do not think that describes the position of 9-A-L very fully. That is a description of the mark of the chain and of the loose rivet.

Prof. KERRY.—Will you take that description, Mr. McLure, and, in conjunction with Mr. Cudworth, prepare a plan showing the piers, and showing the present position of the members and also the chord of the anchor arm?

Mr. McLURE.—Do you want all four ribs?

Prof. KERRY.—I think we might say with details where any particular distortion exists.

Mr. McLURE.—Is this to be just a plan? I cannot show it in perspective very well.

Prof. KERRY.—To be accompanied with a written statement covering the points not readily intelligible by an ordinary plan. Different members are so badly twisted that short of a model I do not think you could prepare anything that would make it absolutely clear.

Mr. McLURE.—How large a piece do you want shown? There are lots of little pieces lying around there?

Prof. KERRY.—The general instruction of the Commission is to determine the cause of the wreck. Anything that does not bear on that is not worth taking.

Mr. HOLGATE.—If, in the description, you can refer to any one of those photographs definitely, in order to fix the point, it might be just as well to do it.

Mr. McLURE.—All right.

The Commission adjourned until ten a.m. Monday morning.

THIRTEENTH DAY.

QUEBEC, P.Q., September 23 1907.

The Commission met at 10 o'clock.

E. A. HOARE, Chief Engineer, Quebec Bridge Company, recalled.

Mr. HOLGATE.—I think you were present during the giving of the evidence of Mr. Kinloch and Mr. McLure?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—They related in chronological order certain matters that they noticed and they detailed some defects that had been noticed in the chords. Do you remember the earliest date at which these were brought to your attention?

Mr. HOARE.—Which chord was that?

Mr. HOLGATE.—Any of the chords.

Mr. HOARE.—The defects on chord 9 anchor arm and the two chords on the cantilever arm 8 and 9 were called to my attention on the 27th August, by Mr. McLure.

Mr. HOLGATE.—Do you feel sure that none of these were brought to your attention before that time?

Mr. HOARE.—No, not before.

Mr. HOLGATE.—Was any intimation given you with respect to any other part of the structure?

Mr. HOARE.—Yes, from time to time. They would refer to anything. Whenever I visited the work I would always ask the question: Is everything all right on the structure? Anything special to call my attention to? And in most cases the answer was 'no.'

Mr. HOLGATE.—Would there be anything of that nature which was reported to you which would not appear in the written reports written by Mr. McLure?

Mr. HOARE.—No, in fact everything of importance, in fact every detail is mentioned in the daily report, in fact the daily report was a description of the work done,

a complete description of the work done and included important and unimportant details.

Mr. HOLGATE.—When were daily reports made up by Mr. McLure? Take for instance, one day's work, would that report be made out on that day or on the following day?

Mr. HOARE.—I could not say the exact time he made that out; I think he made that out every evening.

Mr. HOLGATE.—What day would you receive them on?

Mr. HOARE.—I would not get them myself daily in writing; he would make my office book up from time to time; I would take it out occasionally and——

Mr. HOLGATE.—Where was that office book kept?

Mr. HOARE.—In my office in Quebec; it is an exact copy of his field book.

Mr. HOLGATE.—How was that entered up, daily?

Mr. HOARE.—It was not actually entered up daily, but the records are daily.

Mr. HOLGATE.—There might be a period of——

Mr. HOARE.—Two or three days before my book was written up.

Mr. HOLGATE.—Two or three days, so that anything that Mr. McLure might have reported in the form of diary which was written up in your office, you might not have a complete report of that until several days after?

Mr. HOARE.—Well, not in writing, but verbally. If anything happened, or anything out of the common occurred, he would confer with me, that is, if I was not at the bridge that day.

Mr. HOLGATE.—By telephone?

Mr. HOARE.—By telephone and on the work; whenever I visited the work he would discuss everything fully.

Mr. HOLGATE.—Would that mean daily communications between you and Mr. McLure?

Mr. HOARE.—Practically daily communication.

Mr. HOLGATE.—But not necessarily daily communication?

Mr. HOARE.—No, the only days when perhaps there would be no discussion would be when they were making erection preparations, that is moving the travellers, the rigging, for putting in panels ahead.

Mr. HOLGATE.—Had you a private telephone line?

Mr. HOARE.—Yes, I had a private telephone in the office and one in my house, and I hardly missed a day without calling one or other of them up and sometimes both of them up by telephone morning and evening.

Mr. HOLGATE.—When you speak of a private telephone, that is a telephone solely for your own use?

Mr. HOARE.—The telephone was in the office at the bridge.

Mr. HOLGATE.—In the Quebec Bridge Company's office?

Mr. HOARE.—No, in the Phœnix Bridge Company's office, but the Quebec Bridge Company's office at the bridge was adjoining it.

Mr. HOLGATE.—There was just one telephone, then, at the bridge?

Mr. HOARE.—Just the one telephone, yes.

Mr. HOLGATE.—Then, if anything had been observed by Mr. McLure on August 20th, you might not have known of that for some days later?

Mr. HOARE.—He would not have waited so long as that; anything that occurred on the 20th he would have notified me.

Mr. HOLGATE.—As a matter of fact, can you say when his observations of the 20th of August became known to you?

Mr. HOARE.—I have nothing on the 20th of August, I have nothing of importance noted in my book.

Mr. HOLGATE.—In whose handwriting is that diary?

Mr. HOARE.—Mr. McLure's.

Mr. HOLGATE.—Mr. McLure's own handwriting?

Mr. HOARE.—Yes.

Mr. HOLGATE.—And that was written up in your office in Quebec?

Mr. HOARE.—No, in his own, at the work.

Mr. HOLGATE.—And transferred to your office?

Mr. HOARE.—No, given to me when I went out.

Mr. HOLGATE.—And the only times you saw the diary were when you visited the work?

Mr. HOARE.—No, I always kept the diary in office for reference; I kept this diary in the Quebec office for reference from time to time as to what occurred on the work, and had it made up; I used to take it to the work now and then when I went there.

Mr. HOLGATE.—Well, then in order to keep your office diary record in agreement with Mr. McLure's diary which he kept on the work, when you visited the bridge you took your office copy to the bridge and compared it with Mr. McLure's field copy and entered up any omissions from your office copy from Mr. McLure's field copy.

Mr. HOARE.—No, I did not compare my copy with his; he would write this up for me from his.

Mr. HOLGATE.—Mr. McLure would fill it in, then?

Mr. HOARE.—He would fill these in from his field copy.

Mr. HOLGATE.—So then your office diary was made up from time to time and back dates filled in on the occasion of your various visits to the bridge?

Mr. HOARE.—Yes.

Mr. HOLGATE.—You have filed something showing your visits to the bridge?

Mr. HOARE.—I have put in something, yes.

Mr. HOLGATE.—Were you there on August 20th, Mr. Hoare?

Mr. HOARE.—I am not quite positive; I could not say right off whether I was there or not.

Mr. HOLGATE.—What have we here to show?

Mr. HOARE.—I do not think there is anything to show.

Mr. HOLGATE.—By reference to a private diary could you tell us what your movements were in regard to visiting the bridge?

Mr. HOARE.—Well, I might; I am not quite sure about that; I do not actually know every day I visited the bridge; sometimes I used to go on consecutive days and I did not enter it up; in fact, sometimes I did and sometimes I did not.

Mr. HOLGATE.—What we would like to know would be your movements in regard to the bridge work from the 20th of August forward to the 29th?

Mr. HOARE.—I am positive about the 28th, that I was there on the 28th? I can speak from memory that I was there on the 28th, all day long.

Mr. HOLGATE.—I have no doubt that you could, from consulting your own private diary, say just what your movements were in that period?

Mr. HOARE.—Possibly I could. The only day I am positive about now is the 28th. I was there all day on the 28th.

Mr. HOLGATE.—Will you give us a memorandum covering that information?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Then, what was the first report of Mr. McLure's that drew your special attention in that period to the work?

Mr. HOARE.—On the 27th he showed me a sketch.

Mr. HOLGATE.—In Mr. McLure's absence from the work whose duty was it to write up that diary and keep the field notes?

Mr. HOARE.—He attended to it always.

Mr. HOLGATE.—But in his absence? We have a statement from him that he was in the hospital?

Mr. HOARE.—Well, it was not written up, he wrote it up when he came out.

Mr. HOLGATE.—Who, then, kept the notes from which he would write up that diary?

Mr. HOARE.—Mr. Kinloch would keep the account of the daily work.

Mr. HOLGATE.—Mr. Kinloch kept the notes?

Mr. HOARE.—He was supposed to keep track of everything during Mr. McLure's absence in the hospital, and when Mr. McLure was sick, I called up Mr. Kinloch, and several times during the day when I was not at the bridge myself to know if everything was going on smoothly, and if he required any assistance, and his reply was that there was nothing of special importance taking place, that they were principally engaged in the moving of travellers and rigging for the next panel.

Mr. HOLGATE.—Were you at the bridge during Mr. McLure's absence in the hospital?

Mr. HOARE.—Yes, sir; and I took every pains to ascertain from Mr. Kinloch if he required any assistance and if he would be overworked during Mr. McLure's sickness, and he—in fact he laughed at me for asking the questions.

Mr. HOLGATE.—Now, Mr. Hoare, would you please go on with what took place from the 27th of August forward?

Mr. HOARE.—Mr. McLure reported that the four ribs of chord 9-A-L showed deflections towards the axis of the bridge, and showed me a pencil sketch of it. He told me that that was reported to him, that it was discovered by Mr. Kinloch, and that as those bends had not been discovered before, he had reported the matter that day to Mr. Cooper, and that Mr. Birks had reported in the same manner to Phœnixville. He also stated that he thought it would be advisable to go to New York and describe it, as it took so long to communicate by telegram on account of delays in getting messages through; there was a strike at the time. He also stated that Mr. Yenser would not move out the traveller. My answer was that that was all right, and that he had better go to New York and Phœnixville. But before going, I wished him to check up everything—that is to take levels at the main pier, to examine the posts, and see that everything was in perfect line, and be perfectly sure that he had full information on the general condition of the bridge before leaving. In the morning of the 28th, I went out to the bridge and met Mr. McLure and Mr. Kinloch and Mr. Birks—they were together at the office.

Mr. HOLGATE.—Was Mr. Yenser present?

Mr. HOARE.—Not just at that moment; he showed up a few minutes later. I asked them if they had examined everything as requested the night before. He said everything had been examined, and everything was in perfect condition.

Mr. HOLGATE.—What did you understand he meant by that?

Mr. HOARE.—He meant that everything was in normal condition, referring to the levels of the bridge and the alignment of posts. Everything was working right with the exception of that chord and the two chords mentioned on the cantilever arm.

Mr. HOLGATE.—That is the two chords mentioned to you at that time, or some time previously?

Mr. HOARE.—No, at that time.

Prof. GALBRAITH.—Which chords?

Mr. HOARE.—Two chords on the cantilever arm on the Quebec side.

Mr. HOLGATE.—But I suppose your diary contained references to these under a previous date?

Mr. HOARE.—They are all mentioned here, 8 and 9 chords, the diary refers to them. I asked the question if any rivets or latticing had been broken on chor' 9-A-L, and they stated that there was no visible damage, but that the latticing appeared to be, I think they said, slightly strained.

Mr. HOLGATE.—Do you remember who made that remark?

Mr. HOARE.—It was Mr. Kinloch, I think, made that remark. He said they sounded rather peculiar.

Mr. HOLGATE.—Can you recollect any statements made by Mr. Yenser or Mr. Birks in regard to not only that matter but anything else that took place at that time?

Mr. HOARE.—Yes; when Mr. Yenser appeared on the scene; before he appeared

I was told that the traveller had been moved that morning. I asked him why he moved it. He said he had so many men out, that he thought there was no danger in moving the traveller.

Prof. GALBRAITH.—About what o'clock was this conversation?

Mr. HOARE.—I think that was about half-past ten in the morning.

Mr. HOLGATE.—Was the impression made on your mind at the time, Mr. Hoare, by Mr. Yenser's remark, that he was free from any feeling of danger?

Mr. HOARE.—Yes; he seemed to be quite at ease over it, in the way he spoke to me, judging from his manner. And then I asked Mr. Birks, I think it was, a question if he had figured the effect of moving that small traveller on the 9-A-L chord. He stated it was approximately about 50 pounds to the square inch.

Mr. STUART.—Did he state that he had figured it? Mr. Hoare's answer does not indicate whether he had figured it. I want to know if he really said he had figured it?

Mr. HOARE.—Yes, he said he had figured it; approximately, it was 50 pounds to the square inch. I replied that that was a bagatelle, compared with the stress already on the chord.

Mr. HOLGATE.—Did you understand that his 50 pounds to the square inch was simply the additional compression strain brought on the member?

Mr. HOARE.—Brought on that chord by the moving of the traveller forward. That is what he stated to me.

Prof. GALBRAITH.—As a whole?

Mr. HOARE.—As a whole.

Mr. HOLGATE.—Was any other question discussed by you with Mr. Birks with regard to the question of strain?

Mr. HOARE.—No, I do not think so.

Mr. HOLGATE.—You do not remember that any direct reference was made to the condition brought about by any change in shape of the member?

Mr. HOARE.—No. After that discussion about the traveller having been moved, I told Mr. McLure to hurry off and catch the noon train and go to New York and see Mr. Cooper and lay the facts before him and have a full discussion and come to some decision about it, and then to go to Phœnixville and repeat the same explanations there so that there would be no misunderstanding which might arise by telephoning or telegraphing from the office.

Mr. HOLGATE.—Previous to that moment had you made a personal examination of the parts you were discussing?

Mr. HOARE.—No, I only looked down, I merely went out on the deck and partly out on one of the floor beams so I might be positive where the distortions occurred. I went out there and I did not notice anything from the place I was standing.

Mr. HOLGATE.—You could not discern the bends that these gentlemen were speaking about from the deck?

Mr. HOARE.—Not from where I was on the deck.

Mr. HOLGATE.—Then I understand that you did not go down on the chord yourself?

Mr. HOARE.—No, I did not go down, I was perfectly satisfied.

Mr. HOLGATE.—To verify their reports?

Mr. HOARE.—I was perfectly satisfied with their reports, because they had made careful measurements of the same.

Prof. GALBRAITH.—Do you know anything about the total stress on that chord that morning? You have given me increase of stress.

Mr. HOARE.—I think there was about—I had some conversation about that with Mr. Birks later in the day, and to the best of my recollection, he told me there was about three-quarters of the maximum on it.

Prof. GALBRAITH.—How much did you understand that to be?

Mr. HOARE.—I think I have a note of that somewhere. The maximum was supposed to be over 15,000,000.

Prof. GALBRAITH.—I meant unit stress, or put it the other way.

Mr. HOARE.—I think there was about from 11,000,000 to 12,000,000 pounds on it that day.

Mr. HOLGATE.—Total load?

Mr. HOARE.—Total load on it that day, speaking approximately.

Mr. HOLGATE.—At any rate you cannot say positively now?

Mr. HOARE.—Cannot say positively.

Mr. HOLGATE.—And you do not know this definitely?

Mr. HOARE.—No.

Mr. HOLGATE.—And the information of that nature that you would have received would have been received from whom, Mr. McLure or Mr. Birks?

Mr. HOARE.—Mr. McLure was away, he had gone to New York. I was ascertaining these figures from Mr. Birks as he was keeping track of the effects of the erection on the members from time to time.

Mr. HOLGATE.—You gave us what you understood to be Mr. Yenser's appreciation of the conditions, Mr. Hoare?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Did Mr. Birks pronounce upon the matter?

Mr. HOARE.—Yes. My general conversation with him about that chord led me to conclude that he did not consider it a dangerous matter at all. He considered that it would be necessary to take some steps to repair it, but I did not conclude from the conversation I had with him that he considered it a dangerous affair.

Mr. HOLGATE.—But he approved of Mr. McLure going to interview Mr. Cooper?

Mr. HOARE.—Well, I did not consult him at all about that.

Mr. HOLGATE.—He knew he was going?

Mr. HOARE.—He knew he was going; at least he did not know until I told him he had gone.

Mr. DAVIDSON.—I would like to suggest why should these engineers have considered repair necessary if it was not in a serious and dangerous condition?

Mr. HOLGATE.—I think the facts are clearly stated. Mr. Davidson, there is a condition described.

Mr. DAVIDSON.—Probably that is a conclusion more or less justified by the evidence so I do not insist on that.

Mr. HOLGATE.—Was any scheme of repair suggested to you, Mr. Hoare, with regard to that member or any other member?

Mr. HOARE.—Yes, on one of the chords of the cantilever arm, correspondence took place between Mr. Birks and the Phœnix Bridge Company and Mr. McLure and Mr. Cooper in reference to repairs to one of the chords on the cantilever arm. I have the correspondence about it at the office: 'Splice between chords 7 and 8 on the west truss of south contilever arm. The west centre rib was three-quarters of an inch out of line.'

Mr. HOLGATE.—To what are you referring there, to a letter?

Mr. HOARE.—No, to the daily record.

Mr. HOLGATE.—On what page is that?

Mr. HOARE.—Page 190.

Mr. HOLGATE.—Would that be what you would call a mater of repair?

Mr. HOARE.—Yes, that was a question of repair. That is, they were suggesting certain repairs at Phœnixville and to Mr. Cooper.

Mr. HOLGATE.—Repair would indicate that damage had been done. In this case had damage been done?

Mr. HOARE.—No, we did not consider that any permanent damage had been done, simply a bend, and they were discussing the question of how to straighten that chord rib and hold it in line, hold it in position. Mr. Kinloch suggested a diaphragm being put in there.

Mr. HOLGATE.—What was the date of that entry in your diary?

Mr. HOARE.—August 12.

Mr. HOLGATE.—August 12? Did you inspect this point yourself?

Mr. HOARE.—No, I did not inspect the point, but it was mentioned to me at the time, and we discussed it, and Mr. Kinloch and Mr. McLure together were speaking of a diaphragm, and asked me what I thought of it, and I said I thought it was a very good way of straightening up the chord and holding it.

Mr. HOLGATE.—Then what was done in connection with it?

Mr. HOARE.—Well, there was nothing done, it was in abeyance; it was left to Mr. Cooper and Phœnixville to come to some agreement on that detail, but they had not arrived at any decision. Mr. Cooper differed somewhat from the methods proposed, and it was still under discussion when the bridge collapsed.

Mr. HOLGATE.—Did you understand that this defect that had been discovered was one relating to the erection of the bridge, or did it affect the character of the structure?

Mr. HOARE.—Which one do you refer to?

Mr. HOLGATE.—The one you are now referring to between 7 and 8.

Mr. HOARE.—Would you repeat the question?

Question read to witness as follows: 'Did you understand that this defect had been discovered was one relating to the erection of the bridge, or did it affect the character of the structure?

Mr. HOLGATE.—In other words, was it a local or a general defect?

Mr. HOARE.—I understood it to be a local defect.

Mr. HOLGATE.—Having an effect on the general structure?

Mr. HOARE.—It looked as if the chord was straightened out it would be satisfactory.

Mr. HOLGATE.—Was that the only instance of the kind?

Mr. HOARE.—I think, as far as I can remember at the time, it is the only one of any consequence.

Mr. HOLGATE.—Did you personally investigate any other questions?

Mr. HOARE.—Yes. There was a detail in connection with the top main post, one of the details there.

Mr. HOLGATE.—Which main post do you mean, the centre post?

Mr. HOARE.—The main centre post, yes.

Mr. HOLGATE.—The right or left?

Mr. HOARE.—I do not remember now; I will have to refer to a book to find out which it was, but I remember looking over those. There was a dish in the top section. I do not remember the match mark of section, but there was a dish where the top section bore on certain brackets which was not precisely true. They called my attention to it, and also reported it in the usual way to Phœnixville and Mr. Cooper, but it turned out to be of no consequence, and the corresponding post in the shop was examined to see if that little hollow existed in that post, but they found out it was all right.

Mr. HOLGATE.—Did you correspond personally with Mr. Cooper in regard to any of these matters that were discovered on the bridge?

Mr. HOARE.—Very seldom. I corresponded in some instances, but I left that to Mr. McLure entirely.

Mr. HOLGATE.—I mean in regard to any of these instances we are now discussing?

Mr. HOARE.—No, none of these. The only communication I had with Mr. Cooper was by telegram on August 28, reading: 'Have sent McLure to see you early to-morrow morning to explain letter mailed yesterday about anchor arm chord.'

Mr. HOLGATE.—Is that a letter of yours?

Mr. HOARE.—No, it is Mr. McLure's is referred to, it is his report. I sent a similar message to the Phœnix Bridge Company reading: 'McLure will call to-morrow morning to explain Birks' letter re anchor arm chord. Will see Cooper first.'

Mr. HOLGATE.—Just resume, then, where you left off, at the point when you were talking to Mr. Yenser and Mr. Birks.

Mr. HOARE.—I did not see Mr. Yenser after he said he was satisfied, felt quite comfortable about having moved out the traveller. I do not think I had any further communication with him that day.

Mr. DAVIDSON.—I would like to know if Mr. Yenser actually said that or whether Mr. Hoare simply thought he gave that impression. There is quite a difference to my mind whether Mr. Yenser said it or whether Mr. Hoare received that impression.

Mr. HOARE.—Yes, he told me most distinctly.

Mr. HOLGATE.—Can you repeat, as nearly as possible, Mr. Yenser's own words?

Mr. HOARE.—My words to him were: 'So you have decided to move the traveller out?' And he said, 'Yes, I have.' He said· 'I had a dream,' in a kind of joking way, 'I have had a dream, I think it was foolishness not to move the traveller.' He said, 'I have so many men out on the work that I wanted to employ them.' That is about all he said. As far as I remember that is substantially the conversation we had.

Mr. DAVIDSON.—Who was present at that conversation?

Mr. HOARE.—I do not know that anybody was close by. We were standing at the door outside of the office, standing outside the office in front of the door. I do not know that anybody was there at the time.

Mr. HOLGATE.—I think you did state what time that was?

Mr. HOARE.—About 10.30.

Mr. HOLGATE.—In the morning?

Mr. HOARE.—In the morning.

Mr. HOLGATE.—Of the 28th?

Mr. HOARE.—Yes.

Mr. HOLGATE.—What followed?

Mr. HOARE.—After Mr. McLure left?

Mr. HOLGATE.—At what time did he leave?

Mr. HOARE.—He took the noon train on the Grand Trunk; he took the train that leaves Lévis about one o'clock from Chaudière Curve. Then I remained at the bridge during the rest of that day, at least until about five o'clock, and I had some further conversation with Mr. Birks.

Mr. HOLGATE.—What was that?

Mr. HOARE.—The first thing I asked him to do in the evening was to go and make another examination of chord 9-A-L and see whether the deflections showed up at the south splice and extended into the batten plates, as the sketch I had from Mr. McLure just showed the deflections commencing at the batten plates. It was a matter more for my personal information.

Mr. HOLGATE.—What did he say?

Mr. HOARE.—He said, yes, that it showed slight distortions at the splice between 8 and 9.

Mr. HOLGATE.—I understand this is the report of his examination?

Mr. HOARE.—Just verbal.

Mr. HOLGATE.—That would be at what time?

Mr. HOARE.—It would be in the afternoon. I do not know the exact hour. It was during the afternoon.

Mr. HOLGATE.—This report of Mr. Birks is made after he had made a second examination at your request?

Mr. HOARE.—Yes.

Prof. GALBRAITH.—Did he see anything?

Mr. HOARE.—I said, 'Are you sure that the lattice does not show any signs of buckling?' He said, 'No, not the slightest.' I made the remark that it was rather strange it should be so.

Prof. GALBRAITH.—Did Mr. Birks say anything about the appearance of those ribs near the foot of T-5-Z? That is the division between panels 9 and 10?

Mr. HOARE.—No, he did not make any special remark about it.

Mr. HOLGATE.—Mr. Birks, I understand, reported that there was nothing visible that was wrong in the latticing?

Mr. HOARE.—He said nothing.

Mr. HOLGATE.—And you said you were surprised at that?

Mr. HOARE.—I was surprised, yes.

Mr. HOLGATE.—Had you expected it?

Mr. HOARE.—Well, from the sketch, from the distortions shown on the sketch I thought there might probably be something visible. I thought it was possible there might be something show there.

Mr. HOLGATE.—After Mr. Birks reported this to you, Mr. Hoare, what followed?

Mr. HOARE.—Then I sent for Mr. Kinloch, and asked him to go to the storage yard and see Mr. Clark and get him to refresh his memory about some repairs that were made to that chord in the storage yards during the summer of 1905, in July, I think it was, 1905, as I knew that that chord had met with an accident in the storage yard, and I had not any reference to it at the time, and I asked him to see Mr. Clark and get me a description of what took place at the time, just for present discussion. He went to the storage yard and saw Mr. Clark again about it, and we had a general review as it were of the repairs that were made. It was so long ago I had forgotten what had happened to that chord. I knew it had fallen from the grips; there was a splice plate broken and a pair of angles, speaking now from memory; they were all repaired at the time from a sketch, made at Phœnixville, which was submitted to Mr. Cooper for approval at my request, before it was sent here to be used. I simply wanted to refresh my memory at the time about those repairs.

Mr. HOLGATE.—After doing that what followed?

Mr. HOARE.—We had some conversation about the repairs being considered satisfactory.

Mr. HOLGATE.—What time of the day would that bring it up to?

Mr. HOARE.—Oh, possibly four o'clock in the afternoon.

Mr. HOLGATE.—And what happened after that?

Mr. HOARE.—I think I went to Quebec.

Mr. HOLGATE.—Did you leave any particular instructions with Mr. Kinloch before leaving?

Mr. HOARE.—No, I do not think I did.

Mr. HOLGATE.—Did you have any communication with Mr. Kinloch over the telephone after you went to Quebec that night?

Mr. HOARE.—I am not positive about that.

Mr. HOLGATE.—Or with anybody at the bridge?

Mr. HOARE.—Yes, Mr. Birks called me up on the 'phone.

Mr. HOLGATE.—With reference to what?

Mr. HOARE.—With reference to that chord 9-A-L.

Mr. HOLGATE.—What did he say?

Mr. HOARE.—He merely emphasized what he had already said that the chord was bent from the splice. I suppose he had been plotting it, making a sketch, and that he called me up again to state he was positive the bends occurred in the splice, and that he had thought the bends, some of them—I think he used the word 'some of them,' or to a certain extent, they were there before the chord was put in the bridge. He made some remark of that kind, I could not repeat the exact words. I said: We will just have to await the result of Mr. McLure's trip, and we will possibly get the answer to-morrow—some words of that kind; that is all the conversation that took place.

Mr. HOLGATE.—Have you anything definite to show that Mr. Birks made such a sketch as that?

Mr. HOARE.—No.

Mr. HOLGATE.—He stated over the telephone that he had made such a sketch?

Mr. HOARE.—I understood so—that he had made a sketch or notes of the different

deflections from the splice. I asked him to make a more precise examination after Mr. McLure went away.

Mr. HOLGATE.—Did Mr. Birks in that telephone conversation indicate anything of his apprehension of the nature of this trouble?

Mr. HOARE.—No, he merely stated that he thought that some of these bends occurred before the chord was placed in the bridge.

Mr. HOLGATE.—Did he indicate anything in regard to the possible effect it might have on the bridge?

Mr. HOARE.—Not at all; never referred to it.

Mr. HOLGATE.—Neither one way nor the other?

Mr. HOARE.—Neither one way nor the other. At the time I was on the bridge he did make an allusion to the fact that he did not consider it serious; it was not a serious affair—I think those are the words he used—I do not think it a serious affair.

Mr. HOLGATE.—You think he did express himself?

Mr. HOARE.—While I was on the work after Mr. McLure left.

Mr. HOLGATE.—But at a later period that day he did not?

Mr. HOARE.—No, I do not remember him referring to it at all.

Mr. HOLGATE.—Was there anything further happened on the night of the 28th?

Mr. HOARE.—No.

Mr. HOLGATE.—What were your movements on the following morning?

Mr. HOARE.—Next morning I was preparing some information—some data for the annual meeting of the directors.

Mr. HOLGATE.—Did you visit the bridge?

Mr. HOARE.—No, I did not.

Mr. HOLGATE.—Did you make further inquiry over the telephone?

Mr. HOARE.—No, I was simply expecting to hear from Phœnixville or New York.

Mr. HOLGATE.—Did the bridge call you up?

Mr. HOARE.—They did not.

Mr. HOLGATE.—In connection with the work itself, what did you do that day?

Mr. HOARE.—I did nothing at all except office work—nothing in connection with the outside work.

Mr. HOLGATE.—You received no communication from Mr. McLure?

Mr. HOARE.—No. The only communication I received that day was a telegram from Mr. Deans at Phœnixville, but that did not refer to that chord at all. It referred to the splice 7 and 8 on the west cantilever arm. I misunderstood that message; I thought it referred to chord 9-A-L, but after explanation I found it referred to the cantilever arm—to the original splice that was under discussion.

Mr. HOLGATE.—What was the telegram, Mr. Hoare?

Mr. HOARE (reading).—'Phœnixville, Pa., August 29, 1907—E. A. Hoare, chief engineer, Q. B. Company, Quebec, Que.: McLure has not reported here; the chords are in exact condition they left Phœnixville in and now have much less than maximum load. (Sgd.) John Sterling Deans.' I thought it referred to chord A-9-L, and I felt quite comfortable that day about it. I knew it could not be long before the matter would be taken up.

Mr. HOLGATE.—You might file that bunch of correspondence, Mr. Hoare.

Mr. HOARE.—There are a lot of things here that are just private notes.

Mr. HOLGATE.—That telegram, to begin with.

Mr. HOARE.—I will put all these telegrams in. Here is a sketch that Mr. McLure gave me; is that any good? This is the one first shown me when the chord was first discovered?

Prof. GALBRAITH.—What made you come to the conclusion that this telegram did not include chord A-9-L as well as the others?

Mr. HOLGATE.—I thought that referred to chord 9-A-L.

Prof. GALBRAITH.—I understood you to say that afterwards——

Mr. HOARE.—Mr. Deans explained to me afterwards that it did not refer to that chord at all.

Prof. GALBRAITH.—That is what I am asking you. It was from conversation with Mr. Deans?

Mr. HOARE.—Yes, sir. That is the only communication I had that day with New York or Phœnixville; in other words, I was awaiting the result of their conference before doing that.

(Telegrams put in and marked Exhibit No. 51.)

Mr. HOLGATE.—Then, you had no communication with the work on the 29th of August?

Mr. HOARE.—Not that I can recollect.

Mr. HOLGATE.—Up to what time?

Mr. HOARE.—Until the time of the accident.

Prof. KERRY.—There are two or three points I do not follow very clearly, Mr. Hoare. Your copy of Mr. McLure's diary was written up each time you went to the bridge?

Mr. HOARE.—Generally in that way and sometimes I would send it out by anybody going that way; that is, whenever there was an opportunity to get my book to Mr. McLure I availed myself of it.

Prof. KERRY.—Was it systematically read?

Mr. HOARE.—Yes.

Prof. KERRY.—Every time you received it back you read the entries?

Mr. HOARE.—I used to read it over—yes.

Prof. KERRY.—So that between the time that the book was posted the importance or otherwise of any event was left entirely to Mr. McLure's judgment?

Mr. HOARE.—No, I did not depend upon the book for practical purposes. The book was merely to keep a record of everything because I could not remember what took place from time to time; it was more for a book of reference than anything else. I did not depend on the book for my daily knowledge or information for what was going on at the bridge. I used to get that personally by going there, or if I could not go there at any special time, I was always in telephonic communication.

Prof. KERRY.—But that telephonic communication would be a statement only of the matters that Mr. McLure considered to be important?

Mr. HOARE.—He would repeat everything that was going on, either he or Mr. Kinloch. I would call them up at night and they would repeat the whole process during the day, whether they were moving the traveller, rigging the traveller, or what member had been placed, whether this member fitted, or whether they had to chip the plate—all the details; they explained fully over the 'phone whenever I called them up.

Prof. KERRY.—In other words they gave you every day over the 'phone the same information in detail that was covered in the diary?

Mr. HOARE.—Substantially so—not word for word, but generally speaking. For instance, there were days when I would call up and ask the question: What is going on to-day? They would say: Moving traveller, rigging traveller and so forth, and that would end it. I would say: What is going to happen, and they would say: Continue the same kind of work. Then, I did not trouble my head to ask any further questions. It was only when they were doing any special work that I would ask any questions.

Prof. KERRY.—Mr. McLure was absent from the work from the 17th to the 23rd. At what date subsequent to the 23rd was your diary written up?

Mr. HOARE.—I could not tell you; I do not remember.

Prof. KERRY.—So that there may have been a gap of as much as ten days?

Mr. HOARE.—There would not have been a gap of ten days without my having personal knowledge of the work that was going on at the bridge.

Prof. KERRY.—But without any official record?

Mr. HOARE.—I do not think it is likely that there was that length of time, but even if there was, as I said before, I did not depend upon this book for my personal knowledge. It was simply as a book of reference.

Prof. KERRY.—Then, were you in communication with the bridge on the Monday of the week of the failure?

Prof. GALBRAITH.—The 26th?

Mr. HOARE.—I am not positive. I cannot state now positively whether I was or not.

Prof. KERRY.—Can you let us know that later?

Mr. HOARE.—I think I can.

Prof. KERRY.—Then, on the Tuesday, when did the report of the deflection of the chord reach you?

Mr. HOARE.—Tuesday evening.

Prof. KERRY.—At what time?

Mr. HOARE.—It was after dinner. I do not remember the exact hour.

Prof. KERRY.—Then, practically twelve hours elapsed between the time that the deflection was discovered and the time that the report reached you?

Mr. HOARE.—I understand they discovered it that same day. There would not be that length of time.

Prof. KERRY.—We have evidence to the effect that it was discovered at nine o'clock in the morning?

Mr. HOARE.—I suppose about ten hours.

Prof. KERRY.—What was the reason for that delay?

Mr. HOARE.—I could not speak positively about that beyond the fact that Mr. McLure had to make his measurements. After Mr. Kinloch discovered the bend he called Mr. McLure's attention to it and they had to make measurements, then make their sketches and then they had to get their reports out. They had to occupy all the time before he could reach me. That should take up all the time. That would be the cause of the delay. It takes considerable time crawling along that chord and making precise measurements.

Prof. KERRY.—It was perfectly possible, for example, Mr. Hoare, to call you up at nine o'clock that morning and let you know there was trouble?

Mr. HOARE.—Yes.

Prof. KERRY.—And that was not done?

Mr. HOARE.—That was not done—no.

Prof. KERRY.—And no effort was made to call you till after dinner in the evening to advise you of it?

Mr. HOARE.—Yes, Mr. McLure called me up and said that he was coming in to see me to show me a sketch. I do not see that calling me up earlier in the day would have done any good, because after discovering the deflection necessarily they had to get the information to make a sketch to show all the points of deflection so as to be able to send it over by mail that day to New York and Phœnixville. That was a more important proceeding than coming into town to see me, because I could not have said anything—could not have done anything without having particulars of the trouble. That was the first thing to do and they pretty well consumed the whole time before they could have reached me in getting that information in good shape.

Prof. KERRY.—Do I understand, Mr. Hoare, that if that information that Mr. Kinloch gave Mr. McLure had reached you at nine o'clock in the morning you would not immediately have stopped everything and gone out on the bridge to inspect that yourself?

Mr. HOARE.—No, I should have required more information before I should have taken any action on it. That is the information I gave them in the evening.

Prof. KERRY.—I mean personal inspection, which does not depend on the action of your subordinates?

Mr. HOARE.—If it had been reported to me possibly I might have gone out; that is if they had reported to me that anything serious had presented itself I should have gone out there, but I could not have done anything without getting more particulars and that is what they were getting during the day. I would want to have something definite to work on, because little bendings of the chords of minor importance would occur occasionally from time to time and be examined by the inspectors before they went in the structure.

Prof. KERRY.—Both Mr. Kinloch and Mr. McLure testified that they were seriously disturbed by this occurrence and we understand you that they took the full responsibility of not reporting that matter for the course of an entire day?

Mr. HOARE.—Yes, they did, and I imagine they considered that it was not necessary to report it, as I said before, until they got complete data to lay before me as well as Mr. Cooper.

Prof. KERRY.—Where were you that day, Mr. Hoare?

Mr. HOARE.—In the morning I was in Quebec. I do not remember the exact time, but I was in the office preparing some data for the annual meeting.

Prof. KERRY.—That is on the morning of the 27th?

Mr. HOARE.—Yes, I was there.

Prof. KERRY.—Till what time?

Mr. HOARE.—I could not say exactly till what time, but I was within reach anyway.

Prof. KERRY.—And subsequently?

Mr. HOARE—I think I was in the office all day. Yes, I think I was in Quebec all day.

Prof. KERRY.—Can you file a definite statement with us, Mr. Hoare, covering that?

Mr. HOARE.—Yes.

Prof. KERRY.—Mr. McLure reported to you, Mr. Hoare, that the traveller would not be moved on the evening of the 27th?

Mr. HOARE.—No, he stated that Mr. Yenser said he would not move the traveller.

Prof. KERRY.—On the morning of the 28th you went out and found that the traveller had been moved?

Mr. HOARE.—Yes.

Prof. KERRY.—Did you express any opinion either in the way of approval or otherwise of the movement of that traveller?

Mr. HOARE.—Yes, after putting the question to Mr. Birks, if he knew or if he had considered the effect on chord 9-A.L, and when he stated that it was only 50 lbs. additional stress, I think I said: That does not amount to much anyway. That was all the remark I made.

Prof. KERRY.—You did not take any responsibility or give any definite instructions either to one effect or to the contrary concerning the movement of the traveller?

Mr. HOARE.—No.

Prof. KERRY.—Did you ask Mr. Birks if he included in his calculations the weight of the new panel that was to be erected?

Mr. HOARE.—No, I merely mentioned the traveller.

Prof. KERRY.—So that, it was assumed by Mr. Birks, or did you consider that it was assumed by Mr. Birks that no iron was to be erected?

Mr. HOARE.—Yes, I was under the impression that that was all they were going to do. They were working on the big traveller taking metal off. I was under the impression they were going to continue that work and just work on the small traveller getting it ready for the next panel.

Mr. HOLGATE.—Was that merely an impression or was it a definite understanding?

Mr. HOARE.—That was my belief from general conversation.

Prof. KERRY.—How large a piece of work is the getting ready of the little traveller? After the traveller is moved forward in position what further detail is there before the erection of the new panel would commence?

Mr. HOARE.—It is practically ready then; generally speaking, it is practically ready.

Prof. KERRY.—So that you reasoned that Mr. Yenser, who you knew had been uneasy, would move that traveller forward for no direct purpose and then go back and proceed to take down the big traveller?

Mr. HOARE.—Will you kindly repeat that question?

Prof. KERRY.—You reasoned that Mr. Yenser, who you knew was uneasy,——

Mr. HOARE.—I did not know; I was not under that impression at all. When I saw him in the morning he had a different opinion altogether. I thought he was not uneasy at all. He seemed to act just the reverse way. He spoke to me most confidently about it.

Prof. KERRY.—He had been an entire day before? Mr. McLure reported to you—?

Mr. HOARE.—He reported to me simply the night before that he said he would not move the traveller until he got more information on the chord, but in the morning when I spoke to him outside the office he was of a different opinion altogether; he seemed perfectly at ease.

Prof. KERRY.—Did you still consider that he moved that traveller forward without the least intention of using it?

Mr. HOARE.—I thought so. When I was there they appeared to be working on the big traveller; most of the men on the big traveller and unloading——

Prof. KERRY.—Would you consider that action under your understanding of the programme, to be the action of a perfectly reasonable man?

Mr. HOARE.—Yes, I should say so.

Prof. KERRY.—Mr. Yenser told you, we understand, Mr. Hoare, that he moved that traveller forward partially because he had more men out to work than he could conveniently employ otherwise?

Mr. HOARE.—He did not say that; he simply said: There are too many men out.

Prof. KERRY.—Your interpretation of that would be the same as mine, would it not?

Mr. HOARE.—That he wanted to employ them; that he did not want to have them idle.

Prof. KERRY.—He made no statement as to what he proposed to do with these men?

Mr. HOARE.—No, he did not say anything further.

Prof. KERRY.—After the traveller was moved out?

Mr. HOARE.—No, he did not make any further statement to me on the subject.

Prof. KERRY.—How long did it take to move the small traveller forward?

Mr. HOARE.—I could not say. It was moved before I got out in the morning.

Prof. KERRY.—That is to say it did not occupy more than two hours at the outside.

Mr. HOARE.—Three or four hours, I suppose.

Prof. KERRY.—And the officials of the Phœnix Bridge Company proceeded to add the iron to the next panel without any communication either one way or the other?

Mr. HOARE.—Yes.

Prof. KERRY.—You were not consulted in the matter?

Mr. HOARE.—No.

Prof. KERRY.—You were not advised, previous to the fall of the bridge that any iron had been put on that panel?

Mr. HOARE.—No.

Prof. KERRY.—You did not know they were working on that panel until after you heard of the fall of the bridge?

Mr. HOARE.—I knew they were working on the bridge, but I did not know whether they were putting more metal on or not. My general impression was that they were working on the big traveller, had most of their force on the big traveller, taking it down.

Prof. KERRY.—In your discussions with Mr. Birks and Mr. McLure, were you called on for any decision in regard to their action?

Mr. HOARE.—In what respect?

Prof. KERRY.—As to whether the traveller should be moved forward or whether the work should be continued.

Mr. HOARE.—The night before I was under the impression that the traveller would not be moved forward, and when I arrived next morning I found that it had been moved forward. That is all the information I had.

Prof. KERRY.—The only decision you were asked for was as to whether Mr. McLure should go to New York or not?

Mr. HOARE.—That is it. He asked me that question the day before, and I told him, yes, go the next day—to take the morning train, but that I would be at the bridge before he left.

Prof. KERRY.—Otherwise the action to be taken at this time was not referred to you at all?

Mr. HOARE.—Apart from that?

Prof. KERRY ?—Yes.

Mr. HOARE.—No.

Prof. KERRY.—They simply went ahead and made their own decisions?

Mr. HOARE.—Yes.

Prof. KERRY.—In regard to this member about which there seems to have been a controversy as to whether it was bent before or after it went into place, had you any definite information in the way of the records of your inspectors?

Mr. HOARE.—If it was bent before it went into the work?

Prof. KERRY.—Yes ?

Mr. HOARE.—No, none whatever.

Prof. KERRY.—Had you any reason to believe that it could have been bent before it went into the work?

Mr. HOARE.—No reason at all. The only time that chord sustained any damage was in lifting it in July, 1905, but repairs were made and they had thoroughly examined it in the yard before it was removed to the bridge and everything was found to be satisfactory.

Prof. KERRY.—Being examined by whom?

Mr. HOARE.—Mr. Hudson, myself, Mr. Kinloch and even Mr. Szlapka examined it.

Prof. KERRY.—You knew personally at the time of the discussion that the chord had gone into the bridge straight?

Mr. HOARE.—Yes, taking my inspectors' reports, they are positive when they make a statement of that kind.

Prof. KERRY.—Did you not state a minute ago that you examined that yourself?

Mr. HOARE.—At the storage yard. That was in 1905?

Prof. KERRY.—You found it straight then?

Mr. HOARE.—It was in good condition then.

Prof. KERRY.—So that you knew it went in the bridge in good condition?

Mr. HOARE.—Yes.

Prof. KERRY.—In the discussion in regard to the strains on the bridge you got Mr. Birks' opinion as to how much increase of strain there would be by the moving forward of the traveller. Did you make any calculations yourself?

Mr. HOARE.—No; Mr. McLure said about 70 lbs. Mr. McLure and Mr. Birks in their conversation said that they had approximately checked it and one made it about 70 lbs., and the other 50. It was somewhere probably between these two figures.

Prof. KERRY.—Did you direct or make any calculations considering that member as a post after it had already deflected?

Mr. HOARE.—No.

Prof. KERRY.—Supposing you saw a post under test in a testing machine and visibly deflected out of line, what would you expect to happen?

Mr. HOARE.—If I saw a post in a testing machine under severe strain?

Prof. KERRY.—Under severe strain?

Mr. HOARE.—I would expect that it would fail without some reinforcement.

Prof. KERRY.—And if you did not want that post to fail after you noted the deflection, would you permit the operator to put a pound more stress on the machine?

Mr. HOARE.—I do not think a pound would make much difference. If I was making a test of that kind I would like to put a sufficient load to test the post to destruction to obtain results.

Prof. KERRY.—Did you direct that any systematic measurements should be made of that post while it remained under suspicion and unreinforced?

Mr. HOARE.—You mean the post for testing?

Prof. KERRY.—No, I am referring to that particular chord in the bridge?

Mr. HOARE.—Will you repeat that, please?

Prof. KERRY.—Did you direct that systematic measurements of the deflection of the chord should be made while it remained under suspicion and unreinforced?

Mr. HOARE.—The measurements were made before I was aware that the chord was deflected.

Prof. KERRY.—Did you direct any further measurements to be made when you were aware that it was deflected?

Mr. HOARE.—Only to Mr. Birks on the afternoon of the 28th.

Prof. KERRY.—Did you direct Mr. Birks to make accurate measurements?

Mr. HOARE.—I asked him to make another inspection of the chord and more particularly to see whether the deflection extended beyond the outer edges of the bottom plates.

Prof. KERRY.—So that after the deflection of this member, which we may consider as a post as far as the stress is concerned, had been observed it was allowed to stand for more than forty-eight hours without any measurement being made to see whether the deflection was increasing or decreasing?

Mr. HOARE.—No, I gave no further instructions after I asked Mr. Birks to make that second examination. That was on the afternoon of the 28th. That was the last request I made about making a further examination of the chord. After that I simply awaited the results from Mr. McLure's trip, but in the meantime I did not consider that there was anything dangerous.

Mr. HOLGATE.—Your chief attention seems to have been called to this bend in 9-A-L; did it occur to you to inspector order to have inspected 9-R-A?

Mr. HOARE.—No, it never occurred to me.

Mr. HOLGATE.—Did you inspect the corresponding number of 9-A-L?

Mr. HOARE.—No.

Mr. HOLGATE.—At that time or any other time?

Mr. HOARE.—No.

Mr. HOLGATE.—Has your diary been put in as an exhibit?

Mr. HOARE.—No, I would like to keep it until you get through, because I will have to refer to it.

Mr. HOLGATE.—We had better have it as an exhibit now, because we will have to refer to it.

(Diary put in, filed and marked Exhibit No. 53.)

Mr. HOLGATE.—When tenders were originally asked for this bridge in reply to circular letter, were plans sent in with these tenders?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—Have you got those?

Mr. HOARE.—No, they were all returned to the different bidders.

Mr. HOLGATE.—There were no copies retained by you?

Mr. HOARE.—No, there were none kept. They were all returned to Mr. Cooper and then returned to the different bidders.

Mr. HOLGATE.—Were descriptions of these bridges sent in with the tenders?

Mr. HOARE.—Yes.

Mr. HOLGATE.—Have you those?

Mr. HOARE.—I think the secretary ought to have them.

Mr. HOLGATE.—Will you please let us have the tenders and any descriptive matter that may have accompanied them?

Mr. HOARE.—I think he deposited all he has. I think he deposited the different reports and the different tenders.

Mr. HOLGATE.—What we want is a description of the work they proposed in those tenders.

Mr. HOARE.—I think all of their descriptive matter was returned to them. Take suspension bridges, for example, they had to submit specifications of the character of the work they were to employ.

Mr. HOLGATE.—I find that Mr. Barthe only deposited the figures and documents relating to the Phœnix Bridge Company. It is the other information we would like to have.

Mr. HOARE.—He would only then have the forms of tender filled up, because I am almost positive the special specifications and the plans were returned.

Mr. HOLGATE.—We would like to consult anything you have.

Mr. HOARE.—Anything we have I will produce.

Mr. HOLGATE.—If you make a search for that and show us what there is we can look over it, and if it is necessary to bring it in we will bring it in.

Mr. HOARE.—Yes, I will get all there is.

Witness retired.

The Commission took recess.

AFTERNOON SESSION—THIRTEENTH DAY.

Commission resumed at 2 p.m.

Mr. MCLURE, recalled.

Mr. HOLGATE.—We asked you, Mr. McLure, for a sketch showing the present location of all lower chord members in the anchor arm and a description of the condition of the lower chord members. This description further was to include similar information in regard to the floor beams as at present lying on the ground. Will you produce that information?

Mr. MCLURE.—Yes, it is included in the blue print and description.

(Blue print and description produced and marked Exhibit No. 54.)

Mr. HOLGATE.—In reference to this diagram, the dotted lines indicate the original position of the lower chords and floor beams?

Mr. MCLURE.—Yes, sir.

Mr. HOLGATE.—And the solid lines indicate the present location of the floor beams and lower chords?

Mr. McLURE.—Yes, sir.

Mr. GALBRAITH.—The dotted lines indicates the centre lines of the chords?

Mr. McLURE.—The original centre lines in horizontal projection.

Mr. HOLGATE.—I understand that in the preparation of Exhibit No. 54 you were assisted by Mr. Cudworth?

Mr. McLURE.—Yes, sir.

(The witness also submitted a memorandum showing the deflection of cantilever arm under wind November 12, 1906, and November 16, 1906.)

Mr. HOLGATE.—I understand that these two were taken by yourself and Mr. Cudworth?

Mr. McLURE.—Yes, sir.

Mr. HOLGATE.—And the note dated February 3, 1907, on this same memorandum?

Mr. McLURE.—From an observation by Mr. Kinloch.

Mr. HOLGATE.—Was observed by Mr. Kinloch?

Mr. McLURE.—Yes, sir.

(Memorandum put in, filed and marked Exhibit No. 55.)

FRANK CUDWORTH, recalled.

Prof. KERRY.—Mr. Cudworth, did you assist in the surveys and office work in connection with the preparation of Exhibits 43 to 50 inclusive, and Exhibits 54 and 55?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—And those exhibits are, to the best of your information, perfectly correct?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—You also assisted in the preparation of the diagram showing the positions of the pins at different dates filed as part of Exhibit 30?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Have you brought with you for deposit with the Commission the records of the anemometer?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—You might make deposit of those, please?

Mr. CUDWORTH.—These are the anemometer sheets for the season of 1907 up to and including August 29, the time of the accident.

(Document produced, filed and marked as Exhibit 56.)

Prof. KERRY.—At what date approximately was the cantilever arm completed, the arm itself?

Mr. CUDWORTH.—It was not entirely finished until this season.

Prof. KERRY.—Were the members all in place in 1906?

Mr. CUDWORTH.—No, sir.

Prof. KERRY.—It was during 1907 that it was finished up.

Mr. CUDWORTH.—Yes, sir, I think so. Some of the members that looked to be part of the cantilever arm are really part of the suspended span.

Prof. KERRY.—We understand that these records cover the working season of 1907?

Mr. CUDWORTH.—Not all of it, most of it.

Prof. KERRY.—If not, can you say between what dates?

Mr. CUDWORTH.—No sir, the exhibit shows for itself.

Prof. KERRY.—The records for the year 1906 are where?

Mr. CUDWORTH.—At the bridge.

Prof. KERRY.—Will you kindly arrange to let us have those for deposit, for 1906?

Mr. CUDWORTH.—Yes, sir. This covers what you asked me for the other time.

Prof. KERRY.—Will you tell us briefly, Mr. Cudworth, practically as a matter of information to the engineering profession, how those records were taken, what equipment you had?

Mr. CUDWORTH.—These wind records?

Prof. KERRY.—Yes.

Mr. CUDWORTH.—The anemometer records?

Prof. KERRY.—Can you describe the equipment technically at all. For example, there are several anemometers, or would you prefer to draw up a written statement covering that?

Mr. CUDWORTH.—I can tell you in a few words. In the first place, when the machine came, I checked it up to see if the gearing and everything about it would be correct according to the best authorities on that matter, and I measured it up and found that it was correct, that the length of arms and cups as given would correctly record with that gearing. It is automatic, it records in the office. The velocity is given by a moving vane which we had placed on top of one of the main post peaks as being an exposed position and one most apt to give true results.

Prof. GALBRAITH.—Whose manufacture is it?

Mr. CUDWORTH.—Queen & Company, Philadelphia.

Mr. STUART.—I understand it is the United States standard.

Mr. DEANS.—It is the United States standard cup wind gauge.

Mr. CUDWORTH.—It is one that has been recommended by the weather department of the United States.

Prof. GALBRAITH.—Was there any certificate accompanying the instrument?

Mr. CUDWORTH.—Not to my knowledge.

Prof. GALBRAITH.—Do you know, Mr. Deans?

Mr. DEANS.—No, but it is a guaranteed standard weather bureau cup anemometer, the United States standard, Queen Company, Philadelphia. There is no certificate accompanying it.

Mr. CUDWORTH.—It might be of interest to tell you that we compared our readings at the bridge with those at the observatory here at Quebec at different times, during high winds, and they compared very favourably.

Prof. KERRY.—The cup vane itself was set where?

Mr. CUDWORTH.—It was set on top of the Quebec main post peak, the highest point on the bridge.

Prof. GALBRAITH.—That was completed in 1905, was it not?

Mr. CUDWORTH.—Not the peaks, no sir, as I remember, they were not.

Prof. GALBRAITH.—Not the peaks, the beginning of 1906.

Mr. CUDWORTH.—Yes, I am not quite sure about that.

Prof. GALBRAITH.—Are these standards made in various sizes or is there just one size?

Mr. DEANS.—This is, I think, just one size. I could get a certificate of Queen & Company regarding that instrument.

Mr. HOLGATE.—Is it the same instrument as is used by the Weather Bureau?

Mr. DEANS.—It is the same instrument, their standard. Queen & Co. have a great reputation in the United States for instruments of that kind.

Prof. KERRY.—Then the recording drum was in the office?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Equipped in the ordinary fashion, I presume?

Mr. CUDWORTH.—Yes, with a clock.

Prof. KERRY.—And your tests of the instrument were limited to a check measurement of its dimensions?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—And occasional comparison with the records of the Quebec observatory?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Which were reasonably satisfactory ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Or entirely satisfactory. How close were they ?

Mr. CUDWORTH.—I do not remember any case where we were over 10 miles out.

Prof. KERRY.—With a maximum record of how much maximum speed ?

Mr. CUDWORTH.—I think our maximum was around 60 miles an hour.

Prof. KERRY.—The instrument, of course, went in the wreck.

Mr. CUDWORTH.—Yes, sir, I have a piece of it yet.

Prof. KERRY.—Mr. McLure submitted certain records of truss deflections, Exhibit No. 55, which you identified. How were those measurements taken, Mr. Cudworth ?

Mr. CUDWORTH.—They were taken with a transit, the instrument placed on the ground near the end of a bridge span and the back sight on a point on the railway track through the cut south of the bridge, thence to a target on the bridge itself, two panels back from the end of the cantilever arm.

Prof. KERRY.—That is to say that you had to transit the telescope each time ?

Mr. CUDWORTH.—Yes, sir.

Mr. KERRY.—Are you pretty sure of your judgments ?

Mr. CUDWORTH.—I always used the transit the same way, so there will be no question about it. I always looked at the target with the telescope direct, I had the back sight of the telescope inverted.

Prof. KERRY.—You did not check by reversing the instrument ?

Mr. CUDWORTH.—We did at the time we put the target up.

Prof. KERRY.—The target was a fixed target ?

Mr. CUDWORTH.—Yes.

Prof. KERRY.—Attached at what point ?

Mr. CUDWORTH.—On strut between the T.I. posts cantilever arm.

Prof. KERRY.—That would be 112 feet from the end of the arm, approximately.

Mr. CUDWORTH.—Yes, sir, approximately.

Prof. KERRY.—Were any measurements made other than these submitted in the record ?

Mr. CUDWORTH.—There may have been, I will not be positive.

Prof. KERRY.—But you have no record of other ?

Mr. CUDWORTH.—I would not be positive.

Prof. KERRY.—The question of the movement of the masonry, Mr. Cudworth, was one of very considerable importance. Will you tell us first what equipment you had to determine the elevations shown on Exhibit No. 50. It is a direct case of technical equipment ?

Mr. CUDWORTH.—We use a Queen Company 'Y' level, Queen Company Philadelphia style rod and the bench marks I put in myself.

Prof. KERRY.—The bench marks were what ?

Mr. CUDWORTH.—Iron imbedded in lead, in holes in the pier, in the stone.

Prof. KERRY.—You drilled the side of the pier and just set iron bench marks in with lead settings ?

Mr. CUDWORTH.—Yes, sir, with lead.

Prof. KERRY.—Do you know the delicacy of the bubble and the magnifying power of the glass ?

Mr. CUDWORTH.—I think the time we did this we had the Berger instrument, the Quebec Bridge & Railway Company's level.

Prof. KERRY.—Could you get us that information ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Covering both the delicacy of the bubble and the power of the instrument ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—What would be the length of the sides taken ?

Mr. CUDWORTH.—I would prefer to get you that with other information.

Prof. KERRY.—Will you describe to us how the check measurements at the span were made ?

Mr. CUDWORTH.—The check measurements for the span were made—I used an instrument tape, using a 500 foot tape.

Prof. KERRY.—That tape was originally used in laying out the span ?

Mr. CUDWORTH.—Yes, sir, the same tape that was used in laying out the two previously.

Prof. KERRY.—So that no question of error of tape graduation would possibly come in ?

Mr. CUDWORTH.—No, sir.

Prof. KERRY.—Any further details ?

Mr. CUDWORTH.—No, I do not think of any.

Prof. KERRY.—What precautions were taken to eliminate the ordinary causes of error in tape measurement ?

Mr. CUDWORTH.—The tape was supported at intervals of about 25 feet, was cramped at one end and pulled with the number of pounds, or pulled to correspond to the number at which the tape was standard.

Prof. KERRY.—The supports were carefully levelled.

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—And the maximum distance between them was 25 feet ?

Mr. CUDWORTH.—I could not limit it to feet as I did not measure them, but roughly that is it.

Prof. KERRY.—What calculated corrections were applied to the measurements ?

Mr. CUDWORTH.—Not any. The pull was made right and the temperature happened to be nearly that at which the tape was standard so it was not necessary to apply corrections.

Prof. KERRY.—And the supports were horizontal ?

Mr. CUDWORTH.—Yes, it was measured on a horizontal line.

Prof. KERRY.—And you considered that the sag was so small it was not necessary to calculate it ?

Mr. CUDWORTH.—Yes, sir, we gave 25 more pounds pull on account of that than if the tape was supported continuously.

Prof. KERRY.—I do not follow you altogether there; was that arbitrary or the result of test ?

Mr. CUDWORTH.—In that case it was arbitrary.

Prof. KERRY.—But you decided that 25 pounds pull on the tape would compensate the shortening due to sag ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—But without any calculation ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Did that condition obtain in both the original and final measurements ?

Mr. CUDWORTH.—I cannot say that it did in the former, as it was done by the Quebec Bridge Company, and I only assisted in any way I could and did not do the actual measuring.

Prof. KERRY.—Can you answer that question, Mr. McLure ?

Mr. MCLURE.—No, sir, I was not here at that time. As I understand it, though, the spring pull was not used in the first measurement.

Prof. KERRY.—How was the tape supported in the first measurement, Mr. Cudworth ?

Mr. CUDWORTH.—About the same way, by putting cleats on the wooden false work legs and they are approximately 25 feet apart. It was then measured on a horizontal line and the cleats were put on with a measure.

Prof. KERRY.—Would you feel justified in saying that the only possible instrumental error as between the two measurements would be due to differences in the pull, that the temperature was the same?

Mr. CUDWORTH.—I could not say that the temperature was the same.

Prof. KERRY.—Was there any material difference ?

Mr. CUDWORTH.—I could not say.

Prof. KERRY.—Were you not there both times ?

Mr. CUDWORTH.—Yes, sir. I could not give you the number of degrees difference.

Prof. KERRY.—Would it lie within ten or twenty degrees ?

Mr. CUDWORTH.—I do not remember that. If I was doing the work myself I would record that but I would not remember it.

Prof. KERRY.—You have a full record of the final measurement ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Who has the record of the original measurements, who had charge of the measuring at the time ?

Mr. CUDWORTH.—I think Mr. Lanthier, acting for Mr. Hoare.

Prof. KERRY.—Would Mr. Lanthier's measurements be on record in your office, Mr. Hoare ?

Mr. HOARE.—I think so.

Prof. KERRY.—We would be glad if you would look it up for us, please.

Mr. HOARE.—I will look them up.

Prof. KERRY.—You might submit a note covering the technical detail of that measurement, as far as you are acquainted with it.

Mr. CUDWORTH.—The previous one, the first one ?

Prof. KERRY.—The final one. If you have not the first one, you cannot submit it very well.

Mr. CUDWORTH.—No, sir. You understand of course that the two piers are not the same level, so we had to carry the measurement down with an instrument.

Prof. KERRY.—How was that line carried down ?

Mr. CUDWORTH.—With a transit.

Prof. KERRY.—A transit set on the ground ?

Mr. CUDWORTH.—A transit set on the ground at right angles to the axis of the bridge and at some distance from it.

Prof. KERRY.—How was that position first set ?

Mr. CUDWORTH.—The position of the instrument ?

Prof. KERRY.—The position for the instrument.

Mr. CUDWORTH.—It was taken by lining out the side of the pier in one place and the main pier in the other. The measurement was made from a known point on the pier to the fixed end of the tape by using a level rod projecting over the pier carrying the measurement from the tape to the rod with an instrument.

Prof. KERRY.—Was there any stride level on the transit, and was it used ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Can you say anything concerning the adjustment of the stride level ?

Mr. CUDWORTH.—I have been using it right along, I always watch the adjustments of it.

Prof. KERRY.—It had been regularly tested ?

Mr. CUDWORTH.—Yes, sir. I think it was reversed inside, that would correct any error of adjustment.

Prof. KERRY.—In regard to checking up the position of the truss as the work progressed, you made a measurement each time the traveller was moved forward ?

Mr. CUDWORTH.—I do not understand what you mean by measurement.

Prof. KERRY.—Were regular observations of the general positions of the truss made after each movement of the traveller ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—You might give us a little detail in the answer ?

Mr. CUDWORTH.—They were also taken at some other times.

Prof. KERRY.—These regular observations included what ?

Mr. CUDWORTH.—They developed as the work progressed. This season they have been the elevations of the lower chord pin centres, the longitudinal inclination of the main post and observations for alignment, also the position of the end post of the anchor arm.

Prof. KERRY.—Was there a regular set that was made each time that you took observations ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Just a complete set of measurements that were to be taken and that set was taken each time?

Mr. CUDWORTH.—Do you mean that certain things were required or certain things made.

Prof. KERRY.—Was there a regular set of position observations that was made each time, and did these include all points mentioned on both trustees?

Mr. CUDWORTH.—Yes, all.

Prof. KERRY.—Was there any indication of a sidelong movement in the bridge at any time ?

Mr. CUDWORTH.—No, sir.

Prof. KERRY.—Was the equipment used the same as that described for the masonry work, the same transit and level and general methods ?

Mr. CUDWORTH.—Yes, sir, except the tape; we never used a 500-foot tape.

Prof. KERRY.—In connection with your work did you ever notice at any time any unexpected settlements in parts of the bridge or any sidelong movements?

Mr. CUDWORTH.—No, sir.

Prof. KERRY.—The records from the measurements were entirely satisfactory ?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Now, will you tell us in your own words just what you saw at the time that the bridge fell?

Mr. CUDWORTH.—At the time the bridge fell I was at the house, about a thousand feet away and at an angle to the bridge, and my attention was first attracted by an unusual noise. I thought at that time it was a plate dropped, or hit against a column or something, and while I was turning around to look out of the door this noise continued, so I knew it was something unusual, and by the time that had passed through my mind I was looking at it.

Prof. KERRY.—How much of the bridge could you see from the door where you were ?

Mr. CUDWORTH.—Just a little more than what is shown there (producing a negative).

Prof. KERRY.—That photograph was taken from the door ?

Mr. CUDWORTH.—Taken from the yard just back of the house and perhaps 15 or 20 feet from the door. It is taken lower down, that is all.

Prof. KERRY.—What did you notice as soon as you were able to look at the bridge itself ?

Mr. CUDWORTH.—My attention was directed principally to the top of the main post and the main post peaks. I have no remembrance of seeing the traveller nor did I look at the anchor arm. I might have seen the traveller had it been there, but I do not think it was and I did not see the anchor arm, I did not look for it.

Prof. KERRY.—And what did you note with regard to the movement of the main posts?

Mr. CUDWORTH.—The main posts had three distinct motions while I saw them. I presume the sound took a second to come over there and it took me a second or a second and a half to get in position to see the bridge, so when I looked at the main posts they were falling. The first decided movement I noticed in any other direction was towards Quebec, it was falling towards the river, but the first decided thing I noticed was a motion towards Quebec and this continued for a very small space of time and then I noticed that—it is a little hard to describe this—the motion that took

my attention more then was one towards the river, and the motions in those two directions stopped and the posts went down, they just seemed to sink out of sight.

Prof. KERRY.—That would be that probably all three motions were going on at the same time.

Mr. CUDWORTH.—Yes, they were; that is why it is hard to describe them.

Prof. KERRY.—You first of all noticed the falling over of the peaks towards Quebec, as being the most prominent movement?

Mr. CUDWORTH.—Yes, it was falling both down and also slightly towards the river at the same time.

Prof. KERRY.—Then next the fall towards the river became——

Mr. CUDWORTH.—Became more noticeable.

Prof. KERRY.—Then finally the drop of the posts.

Mr. CUDWORTH.—Then it did not seem to move any way except to sink right down. My idea of the position at the time corresponds about to the position of the peaks as they are now, in the plan.

Prof. KERRY.—Could you make a guess at the length of time that elapsed from the first sound you heard until the posts had disappeared?

Mr. CUDWORTH.—I should say it would take a second for the sound to come that distance, about. It would take another second at least, if not a little more, to turn around to look at it. Then it is pretty hard to say, perhaps one and a half or two seconds that I saw the bridge.

Prof. KERRY.—The time estimate is necessarily pretty rough, but five seconds would perhaps cover the whole movement?

Mr. CUDWORTH.—Yes, sir, it certainly was not over five seconds, I think.

Mr. HOLGATE.—Mr. Cudworth, could you indicate on plan marked Exhibit No. 25 just where you were standing at the time of the collapse?

Mr. Cudworth indicated the point on the plan and marked the place with the letter X and his initials F. E. C., and, continuing, said: I saw that the peaks remained the same distance apart as they went down; they did not become separated. The parts, as I saw them, seemed to fall as a unit.

Prof. KERRY.—That is to say practically that all the upper bracing was effective in the earlier stages of the fall?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—You might take up the history of the bridge as it came to your knowledge, say, from about August 19—anything that bears upon the subject of our inquiry.

Mr. CUDWORTH.—During a considerable portion of the time on August 22, 23 and 24, I was engaged in work on the bridge in connection with the field engineering report which you have. Is that what you want?

Prof. KERRY.—Yes, and did you notice anything at that time of any account?

Mr. CUDWORTH.—No.

Prof. KERRY.—And you heard no report?

Mr. CUDWORTH.—No, sir.

Prof. KERRY.—You might just continue.

Mr. CUDWORTH.—The results which were obtained on those days compared very favourably with those previously obtained and were, in a general way, what were expected. During the 27th and 28th I was most of the time on the north shore in connection with the foundations for the wood and steel false work.

Prof. KERRY.—Isn't there a gap in your time? The 25th was Sunday, was it not?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—On the 26th were you on the north shore?

Mr. CUDWORTH.—The 27th and 28th—Tuesday and Wednesday.

Prof. KERRY.—What happened on the 26th—anything?

Mr. CUDWORTH.—I think on part of the 26th and part of the 28th and most of the 29th I was engaged in photograph work at the office on the south shore.

Prof. KERRY.—That is printing and developing?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Did you make any personal examination of any of the members that were under discussion. You heard the discussion, I suppose?

Mr. CUDWORTH.—Yes, sir, I heard some discussion.

Prof. KERRY.—You were practically not on the south span of the bridge until when that week? Were you on the span on the 29th?

Mr. CUDWORTH.—I do not remember that I went to the front on the 29th at all —that is out to the suspended span.

Prof. KERRY.—You had not an opportunity to personally examine any of the members and you were not in any way connected with any of the measurements that were made?

Mr. CUDWORTH.—No, sir, except the measurement test on the main pier with Mr. McLure before he left for New York.

Prof. KERRY.—To test the elevation?

Mr. CUDWORTH.—Yes.

Prof. KERRY.—Did you hear anything in the way of conversation, Mr. Cudworth, that would bear very directly on the object of the enquiry?

Mr. CUDWORTH.—No, sir, I do not think so.

Prof. KERRY.—You have examined the wreckage pretty carefully since the accident?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—You might tell us generally what you noted particularly there as bearing again on the object of the enquiry?

Mr. CUDWORTH.—I do not think I have noticed anything but what was brought out by Mr. McLure in his evidence—nothing new.

Prof. KERRY.—Your observations will fully agree with those of Mr. McLure in his evidence?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Did you ever, in the regular course of your work, make any effort to determine the, what you might call, geometrical relation between a vertical plane continuing the centre line of the bridge and the axis to the end of the pins?

Mr. CUDWORTH.—Yes, sir. We checked the 24 inch pins of the main shoes by sliding a rod through the holes in a pin.

Prof. KERRY.—Did you find it was exactly at right angles to the vertical plane I have described?

Mr. CUDWORTH.—I think we found an error of something like a sixty-fourth of an inch.

Prof. KERRY.—That was the only one that was tested?

Mr. CUDWORTH.—Both pins were tested.

Prof. KERRY.—You tested two 24 inch pins, one at the bottom of each main post?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—That error of a sixty-fourth, if that be the amount of it, will be more particularly an error in the pedestal setting, would it not?

Mr. CUDWORTH.—Did you mean whether the two planes were exactly at right angles to centre line of the bridge; did you refer to the position of the pin itself in regard to that line?

Prof. KERRY.—I meant the centre line, as to whether it was correct both in the sense of it being exactly at right angles to the centre line——

Mr. CUDWORTH.—The axis of the pin was in a plane perpendicular to the truss plane?

Prof. KERRY.—It would be horizontal?

Mr. CUDWORTH.—I could not give that to you now.

Prof. KERRY.—Have you any record on that point?

Mr. CUDWORTH.—I have a record of it.

Prof. KERRY.—You took the elevation at both ends?

Mr. CUDWORTH.—The elevation at both ends and for transverse alignment.

Prof. KERRY.—You might look that up for us, will you? Will you tell us in what order the chord sections were placed in the false work?

Mr. CUDWORTH.—They were placed in the following order: 2, 1, 3, 4, 5, 6, 7, 8, 9, 10, 11—both trusses at the same time—the corresponding chords.

Prof. KERRY.—Your test on the 24 inch pins showed it to be very closely in exact alignment; would that be a proof that all intermediate pins were also very close to true alignment?

Mr. CUDWORTH.—No, sir, it would be no proof whatever.

Prof. KERRY.—Because the chords were not bolted up?

Mr. CUDWORTH.—That is as far as the field work goes, I mean.

Prof. KERRY.—Did you examine the top chord to any extent during the progress of your observations?

Mr. CUDWORTH.—It was certainly examined for alignment.

Prof. KERRY.—For the cross alignment of the pins?

Mr. CUDWORTH.—No, sir, the member itself was, but not the pins.

Prof. KERRY.—The member itself was in what way?

Mr. CUDWORTH.—That is in taking the longitudinal inclination of the centre posts the position of the member was determined.

Prof. KERRY.—Have you any reason to believe that the axes of the pins on both chords were not accurately at right angles to the central plane of the bridge?

Mr. CUDWORTH.—No, sir, the first chord was set so that they would be in position. The first chord set was No. 2.

Prof. KERRY.—And all the subsequent members of both the upper and lower chords went in without difficulty?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—In such a form as to indicate that they were occupying their true geometrical position?

Mr. CUDWORTH.—Yes, sir.

Prof. KERRY.—Can you say off-hand, Mr. Cudworth, what the maximum sideways movement of the end of the pin has been observed to be?

Mr. CUDWORTH.—Of the pin itself with reference to the member with which it is placed or with reference——

Prof. KERRY.—To the central plane of the bridge.

Mr. CUDWORTH.—That was rather more at the time of the erection of the anchor arm than at any other time. It depended on the way the false work towers took their load on the different sides.

Prof. KERRY.—That is to say the effect of the settlement of the false work was more noticeable than the effect of any unequal settlement of the cantilever arm while it was in progress of construction?

Mr. CUDWORTH.—Yes, sir, that would express it.

Prof. KERRY.—You cannot recall what the maximum figures would be?

Mr. CUDWORTH.—No, sir, I cannot.

Prof. KERRY.—Is there a record of that?

Mr. CUDWORTH.—I think there are records of some work that was done in that connection. I will see if I can find them. The points acted differently after the cantilever arm was under erection when the members were under stress.

Mr. HOLGATE.—Is there anything you would like to say in explanation, Mr. Cudworth?

Mr. CUDWORTH.—No.

Mr. HOLGATE.—Are there any points you would like Mr. Cudworth to bring out, Mr. Deans, particularly?

Mr. DEANS.—I thought the Commission would like to know that we appreciated the necessity of being careful to show all the details in connection with the setting of

the shoes on these blue prints and to see that they were conformed with. Mr. Scheidel, who had charge of that, was here at the time of the setting of these shoes to see that it was acurately done. We assumed that if we started right there, with a careful inspection of the material in the shop, and if the borings were accurate it would proceed uniformly from that point. The setting of the shoes was all done under the supervision of Mr. Scheidel and it was all laid out on little blue prints. We thought that if we started square and level the rest of it would come out right. Mr. Cudworth remembers that.

Mr. CUDWORTH.—Yes, he was there.

Prof. GALBRAITH.—I think that is the point of the examination. You have summarized it.

Mr. DEANS.—We appreciated the importance of sending an engineer here for that purpose.

Mr. HOLGATE.—Who was the engineer in charge at that time?

Mr. DEANS.—Mr. Scheidel, who had charge of all the details.

Mr. HOLGATE.—Your resident engineer? Was that prior to Mr. Birks' time?

Mr. DEANS.—I think so, but even if Mr. Birks were here we thought it of sufficient importance to have Mr. Scheidel here because he got up the details and knew how important that was. We sent him in addition to any other men on the ground to see that the bridge was started right. Mr. Birks was here, Mr. McLure reminds me.

The witness (Mr. Cudworth) retired.

Mr. KINLOCH recalled.

Mr. HOLGATE.—Mr. Kinloch, there are some matters that have come to your knowledge since your last examination in regard to part of the lower chord system. You will just explain what those are?

Mr. KINLOCH.—At A-4-L chord I find that eight feet from the field splice with A-3-L there are two plates in between two outside west ribs each resting on the bottom angle of the chord ribs and inclined from the horizontal about 70 degrees. Between the two east ribs the same distance back from the field splice, A-3-L and A-4-L, I find three oak blocks with a small plate. The top of the blocks is one foot from the top of the ribs of the chord. The outside measurement on that chord from the east rib to the east centre rib on the top is 19¼ inches and on the bottom 19⅜ inches. From the west centre rib to the west rib the distance is 19½ inches top and bottom. These measurements were taken back to back of the plates.

Mr. HOLGATE.—When was that blocking put in between the ribs and also when were those spreaders—I suppose you call them spreaders——

Mr. KINLOCH.—Spacing plates.

Mr. HOLGATE——between the west rib and the west centre rib put in?

Mr. KINLOCH.—That is beyond my knowledge. They were there when I came on the bridge. I was informed by Mr. McLure that plates were used for spacing the webs in the shop and I suppose the blocks were used for that same purpose. I have no personal knowledge of the matter.

Mr. HOLGATE.—Was that an exceptional instance or was it used in different places?

Mr. KINLOCH.—I have no definite knowledge of it having been used in any other place than between the east rib and the east centre rib of chord A-8-R of the cantilever arm, but there were other instances.

Mr. HOLGATE.—Was that to secure safety in handling during transportation?

Mr. KINLOCH.—No, sir

Mr. HOLGATE.—Do you know what it was for?

Mr. KINLOCH.—Only what I have been told, but it was not necessary for that.

Mr. HOLGATE.—In what way would that be necessary?

Mr. KINLOCH.—In assembling the four ribs together in the shop.

Mr. HOLGATE.—To ensure the spacing?

Mr. KINLOCH.—To ensure correct spacing.

Mr. HOLGATE.—Would that account for the tight wedged condition it is in now?

Mr. KINLOCH.—Probably Mr. Meeser and Mr. Edwards would give you more information on that. I could make a guess at it, but as that is done in the shop they might tell you more about it than I could.

Mr. HOLGATE.—At any rate you found it in several instances on the lower chord?

Mr. KINLOCH.—Yes.

Mr. HOLGATE.—They were left that way in the bridge?

Mr. KINLOCH.—Yes, they had not been taken out. They should be taken out when they come to clean up.

Prof. KERRY.—These oak blocks that you mentioned were in your opinion placed there before shipment from Phœnixville?

Mr. KINLOCH.—Yes.

Prof. KERRY—If you had noted their presence what would you have thought of them?

Mr. KINLOCH.—I would have thought what I have said, that they had been used to space the work for riveting.

Prof. KERRY.—They had simply forgotten to take them out.

Mr. KINLOCH.—They were too hard probably for some one to take them out, and they let them go for the next man to take them out.

Mr. HOLGATE.—I do not quite understand how they are so tightly fixed there?

Mr. KINLOCH.—I do not know; if they built these chords on the side I suppose they used these blocks for the spacing and to take the weight while they were riveting. I am not familiar with it.

Mr. HOLGATE.—At any rate they were not in your way during the process of erection.

Mr. KINLOCH.—No, you would not know they were there until you saw them.

Mr. HOLGATE.—They were about the second lacing panel?

Mr. KINLOCH.—They were right at the tie angle.

Mr. HOLGATE.—Between the first and second lacing panel?

Mr. KINLOCH.—Yes.

Mr. STUART.—They are quite visible?

Mr. HOLGATE.—Yes.

Prof. KERRY.—Referring to your previous evidence, Mr. Kinloch, there are one or two points that we want to get cleared up. Can you give us any estimate of the period of time that elapsed between the first time that your attention was drawn to the fall of the bridge and the time that the bridge was fully down?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Can you make any guess at it?

Mr. KINLOCH.—I would not be sure within fifteen seconds or five. I would not want to say it because I would not be sure and it would not be any use to you. I do not know anything about it.

Prof. KERRY.—It was simply a very short period of time and you were unable to judge it?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—Have you examined the ends of the different lower chord members since the accident?

Mr. KINLOCH.—Some of them I have not thoroughly, but I have examined some of them.

Prof. KERRY.—You gave the orders for the final riveting of the joints, did you not?

Mr. KINLOCH.—I let them rivet them when they were tight.

Prof. KERRY.—What method did you follow in order to determine when they were tight?

Mr. KINLOCH.—I had a little tool, a moulder's spatula. If I had not that I took the end of my knife, and if I could enter this I did not call them tight.

Prof. KERRY.—Just thrust that in between the two bottom chord angles?

Mr. KINLOCH.—No, the webs.

Prof. KERRY.—At the bottom?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—In every case before it was riveted up you could not get the knife blade in there?

Mr. KINLOCH.—No, sir.

Prof. KERRY.—Have you noted, on the ends of the members since the fall of the bridge, anything to indicate that they were or were not in close contact?

Mr. KINLOCH.—No, sir, I am not sure of that although some of the tops and some of the bottoms opposite different chords look as if they had more strain. Whether it is due to the fall or not I cannot say.

Prof. KERRY.—That is to say that the upper side of the joint would indicate a heavier strain than the lower side?

Mr. KINLOCH.—Yes, and vice versa at different places.

Prof. KERRY.—Does that indication of an extra strain correspond to the way the gaps were left for the camber?

Mr. KINLOCH.—I have not investigated that fully to know what to say.

Prof. KERRY.—Would you mind looking into that with that in view, Mr. Kinloch, and just see what you can observe?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—One of the witnesses referred to an incident shortly before the collapse of the bridge, to the fact that the erection stringers were sent out on to the bridge to be put in place, sent back again, then finally brought out and erected. Do you know anything of the detail of that movement?

Mr. KINLOCH.—No, sir, I do not.

Prof. KERRY.—You simply did not notice it at all?

Mr. KINLOCH.—I know the erection stringers were out there and were sent back again; that is all. What they were sent back for I do not know. I was not paying any attention to it because frequently stuff was sent back that way; they were not ready for it.

Prof. KERRY.—Do you remember about what time this took place?

Mr. KINLOCH.—No, I do not.

Prof. KERRY.—It would probably have been on the Wednesday afternoon, would it not?

Mr. KINLOCH.—I think it was on Wednesday afternoon. The probability was that it would be Wednesday afternoon and I am pretty sure now it was Wednesday afternoon.

Prof. KERRY.—Could you describe very shortly the switch connections between the two tracks on the bridge?

Mr. KINLOCH.—You go in from the yard over the east main line track?

Prof. KERRY.—When you speak about the east main line track you mean the track on the Quebec side?

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—The railway man's term deals with the direction of the traffic?

Mr. KINLOCH.—It was the track on the Quebec side and then right on about three or four feet of a parapet wall on the approach span, or right at the end of the approach span there is a switch stand.

Prof. KERRY.—That is at the south end of the approach span?

Mr. KINLOCH.—At the south end of the approach span. That throws it on the Montreal track or the Quebec track. There are two tracks that run out.

Prof. KERRY.—There is a single track in front of the office?

Mr. KINLOCH.—No, a double track. The switch was in front of the office, the point of the track was just in front of the office.

Prof. KERRY.—But there was a double track coming down from the storage yard?

Mr. KINLOCH.—No, there is one track. There is a double track, but one track was not used; it was dead at the parapet wall. It is the Montreal track.

Prof. KERRY.—That is to say there was a switch, so that a train coming from the storage yard could take either the Quebec track on the bridge or the Montreal track on the bridge.

Mr. KINLOCH.—Yes, sir, but to get on the other track you would have to go back to the storage yard,—to get on the Montreal track that was dead at the parapet wall. There was no cross-over up near the yard or the bridge.

Prof. KERRY.—So that if material was stored on the dead track it had to be thrown on the dead track at the storage yard, pushed down and let stand until required.

Mr. KINLOCH.—Yes, sir.

Prof. KERRY.—There was no cross-over anywhere on the bridge itself?

Mr. KINLOCH.—No, sir.

(Mr. Kinloch marked sketch showing blocking referred to and it was put in, filed and marked Exhibit No. 57).

Witness retired.

Mr. MEESER, re-called.

Mr. HOLGATE.—Mr. Kinloch has just described some wooden blocking and some steel plate wedging in lower chord No. 4 on the side of the cantilever arm and the sketch he has put in illustrates what he described. Could you give us the history of that and the reasons for it?

Mr. MEESER.—It is customary when they build these chords to put in a plate piece and it is milled off to the proper length to keep these chords apart until they are assembled or riveted together, and the only reason that they were there is that they put in wood so as to get the right space. When the ribs are built in most of the cases they have a piece something like that, they stand it on its end, mill it off to the proper length and the rib is laid on top of that until the lacing angles are put on and riveted. Some of these you will find in the chords to-day. That is the blocking that may have been been there. If they had not enough of these other pieces they may have used these blocks to get the required length. It is not a customary rule at all to use wood—always iron.

Mr. HOLGATE.—It would be removed prior to shipment?

Mr. MEESER.—Most always. There are two or three pieces in the Belair yard in which these are in yet.

Prof. KERRY.—Do you recollect any other instance in which wood blocking is used?

Mr. MEESER.—Yes, wood blocking is used. After the chord had been milled they would take these pieces out to use them over again and when it came to the finishing department to put the ribs in the right position they might spring one way an eighth of an inch. After they are milled they are left on their side and they put the blocks in there to hold the chord stationary in its right position until the templet is applied, the holes drilled and the top cover plate or top splice plate put on and bolted fast. But those blocks have to be taken out before the side splice plate is put on.

Prof. KERRY.—Previous to the fall of the bridge, Mr. Meeser, there was a discussion as to whether a certain chord member was considerably bent before it left the shop or not. What evidence have you bearing on a point of that kind?

Mr. MEESER.—I have no evidence but just what I have heard in conversation since I came over here. I have no evidence but what I found out since I came here. I

found out more about it here than I did there. There were two chords that they thought there was something wrong with, and that question had been taken up, I believe, or I found out since, between the Phœnixville Bridge Company and Mr. Cooper, but I did not come in contact with that.

Prof. KERRY.—Was it your business as one of the shop inspectors to see that the chords were as perfectly straight as they could reasonably be made? Suppose a chord had not been made reasonably straight, would you have a record of the fact?

Mr. MEESER.—Yes, sir, we would, but there were none of them ever went out but what they were reasonably straight. We had cut chords apart before they were milled that we did not think were straight, but none of them ever passed out as finished but what we thought were reasonably straight.

Prof. KERRY.—So that you were satisfied that every chord member that was shipped——

Mr. MEESER.—I am satisfied that every chord was straight. There may have been a rib that had some wave in it, but as a chord the chord was straight.

Prof. KERRY.—You tested those in what way?

Mr. MEESER.—With our eye.

Prof. KERRY.—You looked directly along the whole line of the chord?

Mr. MEESER.—Yes, sir.

Prof. KERRY.—And you would expect to detect a wave of what amount?

Mr. MEESER.—Well I think I could easily detect anything over half an inch, easily.

Prof. KERRY.—Did you attempt to check that up to any extent on your visit to Belair?

Mr. MEESER.—We did this afternoon.

Prof. KERRY.—What did you find?

Mr. MEESER.—We found one lying on its side was out $\frac{3}{4}$ of an inch. In those standing up we had $\frac{1}{8}$, $\frac{1}{4}$, $\frac{5}{8}$. Mr. Francis, Mr. Edwards and I were out to-day. The most was $\frac{3}{4}$ in one chord.

Prof. KERRY.—And you attribute that to some extent——

Mr. MEESER.—To the position it is lying in.

Prof. KERRY.—You think if that was——

Mr. MEESER.—Set up the way it goes into the bridge, I do not think you would find as much.

Prof. KERRY.—It would recover itself.

Mr. HOLGATE.—But this one was lying on its side?

Mr. MEESER.—Lying on its side.

Prof. KERRY.—Is that very noticeable to the eye?

Mr. MEESER.—Well, yes, it is now. Mr. Edwards tells me it is the one you and he measured the time you were out there and you said about $\frac{5}{8}$.

Mr. HOLGATE.—Is the deflection due to its own weight?

Mr. MEESER.—I do not know if it is that or lying on the blocks, or what it is.

Mr. HOLGATE.—Is it carrying a load now?

Mr. MEESER.—On one end there is something on it.

Prof. KERRY.—Speaking of the lower chords, at what time in the making up of a member were the pinning holes drilled?

Mr. MEESER.—Practically the last with the exception of drilling the holes for the splice plates.

Prof. KERRY.—That is to say the member was——

Mr. MEESER.—The member was assembled, riveted and milled.

Prof. KERRY.—The shop splices riveted?

Mr. MEESER.—No, sir, all that was put in afterwards. I mean the chord was assembled, it was riveted together, the lacing angles all were put on, they were assembled, riveted, milled, laid out, and then bored.

Prof. KERRY.—The operations subsequent to boring were——

Mr. MEESER.—Sir?

Prof. KERRY.—What was done subsequent to the boring?

Mr. MEESER.—They were put up on the machine and to get the height of our holes we had a gauge and measured up for a certain distance. I have already explained the method of getting our top line. It was laid out on that and then set on the boring mill, which was all of iron on a concrete basis, and bored. After it was put in the boring mill, to be sure that it was right, the men first set it to the scribe lines and then we checked it up. Next when the holes were cut we re-checked it, at the last cut we re-checked it and after it was done checked it again.

Prof. KERRY.—When you had finished with your boring, Mr. Meeser, and your hole was cut to your satisfaction, what still remained to be done on the member?

Mr. MEESER.—The splice plate holes both on the ribs and the splice plate holes on the top and bottom of the big lateral plate were put in; that about finished the chord.

Mr. DEANS.—I think Mr. Meeser misunderstood about the splices, the shop splice was completed before boring?

Mr. MEESER.—I was speaking of the field splice, the chord was all riveted up before there was any boring, everything was completed in that line before any of those other members were touched at all.

Mr. DAVIDSON.—It has been given in evidence that Mr. Birks was strongly of the opinion that that bend which was discovered in the chord had always been in it, that is that it came from the shop in that condition. I would like to know if Mr. Meeser agrees in that position?

Mr. KERRY.—I think Mr. Meeser has already expressed himself.

Mr. DAVIDSON.—He has as a matter of fact; it is just to put the two side by side. He has already I know said they came away straight, but it is evident of course that he does not agree with the other opinion since that was his opinion.

Prof. KERRY.—It seems absolutely clear that if any crookedness existed in any one of those chords it was certainly not seen by Mr. Meeser and that he specially inspected the chords to see if anything of that sort existed.

The Commission adjourned.

FOURTEENTH DAY.

QUEBEC, P.Q., September 24, 1907.

The Commission met this morning at 10 o'clock.

JOHN STERLING DEANS, re-called.

Mr. HOLGATE.—Mr. Deans, who designed the erection plant of the bridge?

Mr. DEANS.—Who designed the erection plan of the bridge?

Mr. HOLGATE.—Plant?

Mr. DEANS.—It was designed by both the engineering department and the erection department of the Phœnix Bridge Company.

Mr. HOLGATE.—Who particularly were the responsible men connected with that?

Mr. DEANS.—The general methods of the erection were decided upon in conference between myself, the computing department and the erection department, and then the details of this method were worked out by each of those departments. The engineering department more particularly had the designing of the main travellers and false

work. The erection department were more directly responsible for the methods in handling the material and the appliances that were necessary to do this handling.

Mr. HOLGATE.—Will you mention the names of the various gentlemen; who were those to whom you have referred?

Mr. DEANS.—The man in principal authority in the designing department or the computing department is Mr. T. L. Szlapka; under him Mr. C. W. Hudson, who had the principal charge of designing the details of the main traveller. In the erection department Mr. A. B. Milliken, superintendent of erection, in principal charge; Mr. G. A. Tretter, his assistant, and Mr. A. H. Birks, engineer of the department.

Mr. HOLGATE.—The outcome, then, of their co-operating was the plan that was used?

Mr. DEANS.—The outcome was the plan that was used in the erection of the structure.

Mr. HOLGATE.—And the final approval of that rested with yourself?

Mr. DEANS.—The final approval rested with myself.

Mr. HOLGATE.—And you did approve?

Mr. DEANS.—I approved all that they did.

Mr. HOLGATE.—Then when erection was commenced on the south shore who was your representative in chief charge on the ground?

Mr. DEANS.—Who was my representative particularly?

Mr. HOLGATE.—The Phœnix Bridge Company's representative?

Mr. DEANS.—Do you mean when we started to erect the false work?

Mr. HOLGATE.—Yes?

Mr. DEANS.—Mr. E. J. Wickizer was the general foreman in charge of the work here, working directly under Mr. A. B. Milliken, who made frequent trips to the work.

Mr. HOLGATE.—Was there a representative of the engineering department there then?

Mr. DEANS.—A representative in Mr. Cudworth who gave centres and elevations for the setting of this false work and the alignment.

Mr. HOLGATE.—Then those are the only two who were there during the erection of the false work?

Mr. DEANS.—I think so; yes, sir.

Mr. HOLGATE.—Then when did you send an erecting engineer to the work?

Mr. DEANS.—An erecting engineer was on the work during the rection of the main traveller as I remember that.

Mr. HOLGATE.—Who was that?

Mr. DEANS.—Mr. C. W. Hudson, who had the charge of designing it.

Mr. HOLGATE.—Did the designing of the main traveller necessarily involve the study of the details of erection?

Mr. DEANS.—Yes, sir.

Mr. HOLGATE.—Then it is probably from Mr. Hudson's familiarity with the design of the traveller that he was sent there?

Mr. DEANS.—He was sent there particularly because he had designed the traveller in connection with the erection department.

Mr. HOLGATE.—How long did Mr. Hudson remain there?

Mr. DEANS.—I cannot give the dates. He remained there, as I remember, until the traveller was erected and I think until they had actually handled some members to be certain that it worked properly.

Mr. HOLGATE.—Was the design of the traveller made to suit the design of the bridge or was the design of the bridge made to suit the design of the traveller?

Mr. DEANS.—The designing and detailing of the bridge was worked along at the same time as the designing and detailing of the traveller and the erection methods, and the traveller was designed to handle to the best advantage the members of the bridge as designed in detail.

Mr. HOLGATE.—In the design of the bridge did you at any period require to alter the design of any of its details in order to suit the traveller?

Mr. DEANS.—I think not after the design of the traveller was once determined upon, because the order of erection of each member of the bridge was decided upon between the man who had charge of the details and the erection department, and therefore the details as they came out would agree with this rotation of erection, and I cannot remember an instance where the traveller was altered to agree with any detail of design.

Mr. HOLGATE.—I gather then from that that the general design of the structure and of its details was made largely with a view to the facility of erection.

Mr. DEANS.—In our first study of the bridge we appreciated that the erection was probably the most important part of the construction, and the designing of the bridge was made to suit the facility of erection and the safety of the bridge during erection. That was our principal motive in the design.

Mr. HOLGATE.—In determining the important details which you referred to, Mr. Deans, who were your assistants to whom you entrusted this work?

Mr. DEANS.—Mr. P. L. Szlapka, designing engineer, Mr. Chas. Scheidal, assistant engineer in charge of detail.

Mr. HOLGATE.—And you would be guided to some extent by their opinions?

Mr. DEANS.—Only in the detailing of the members to suit the methods of erection, which had been determined upon by the erection department.

Prof. KERRY.—As we understand it, then, the idea of erection was clearly kept in view as one of the most important items in the whole bridge construction?

Mr. DEANS.—From the very beginning; yes, sir.

Prof. KERRY.—And the responsibility of that erection under yourself, or the methods of erection under yourself, and the suitability of the bridge for those methods of erection rested on three men: on Mr. Milliken, for the working plan, on Mr. Hudson for the general design of the traveller, and erection gear of that character and on Mr. Szlapka to see that the detailing fitted in with the plans prepared by the erection department.

Mr. DEANS.—And immediately under him Mr. Scheidal.

Prof. KERRY.—Immediately under him Mr. Scheidal?

Mr. DEANS.—Yes, sir.

Prof. KERRY.—Now, where would Mr. Hudson come in? He is a man we have not come across at all. To what department did he belong?

Mr. DEANS.—He was at that time the assistant engineer in the designing department immediately under Mr. Szlapka. He is now consulting engineer in New York with Prof. Merriman.

Prof. KERRY.—His would be a parallel position to Mr. Scheidal's?

Mr. DEANS.—Yes, in a different department of the company.

Prof. KERRY.—Both reported to Mr. Szlapka?

Mr. DEANS.—Yes, both reported to Mr. Szlapka.

Prof. KERRY.—One dealing with the erection plan and the other with the permanent plan?

Mr. DEANS.—Yes, that is correct.

Mr. HOLGATE.—I think you said Mr. Hudson was on the work during the commencement of the erection of the steel work?

Mr. DEANS.—As I remember he remained long enough to see the traveller handle its first heavy members.

Mr. HOLGATE.—Was it then your intention to have Mr. Hudson continue there?

Mr. DEANS.—No, it was not our intention to have Mr. Hudson continue. As soon as the part of the work he was particularly interested in in the office was completed it was the intention to take him back to Phœnixville.

Mr. HOLGATE.—Then did he return to Phœnixville?

Mr. DEANS.—He returned to Phœnixville.

Mr. HOLGATE.—Was Mr. Hudson a well qualified man to have continued in the erection of that structure?

Mr. DEANS.—As far as his ability was concerned he was a very able man, but it was not necessary for him to discuss the details of erection and work up the method of erection to such an extent as Mr. Birks did and therefore we substituted Mr. Birks for Mr. Hudson as the permanent erection engineer on the work.

Mr. HOLGATE.—Mr. Hudson, I believe, was a man older than Mr. Birks?

Mr. DEANS.—Yes, sir.

Mr. HOLGATE.—And had had a good deal of similar experience in other work?

Mr. DEANS.—Mr. Hudson had had a great deal of experience in the designing and detailing of work; he had not had any special experience in the actual erection work. I mean by that actually being with the men and in contact with erectors; he had not had that experience.

Mr. HOLGATE.—Having a competent foreman, such as Mr. Yenser has been described to be, was there further necessity for an engineer skilled in erecting on the work? We understand that Mr. Yenser was in complete charge?

Mr. DEANS.—Yes. Well, we considered in work of this magnitude it was necessary to have an engineer on the ground in addition to the foreman.

Mr. HOLGATE.—What we have in mind is, I think it is in evidence, that Mr. Birks had, previously to this work, had no field experience in erection ?

Mr. DEANS.—That is not correct.

Mr. STUART.—I do not think that is in evidence ?

Mr. DEANS.—He had had experience. You even asked me to get a list of the places where he had worked and I got it, at least I did have it.

Mr. HOLGATE.—Have you got a further record of Mr. Birks' erection work ?

Mr. DEANS.—I conferred with Mr. Milliken and I did make it up at the time, I thought you wanted it the next day. I know he was on bridges on the Southern Railway which we were erecting, also on bridges on the Lehigh Valley and on the Reading Railway.

Mr. HOLGATE.—Of course we look upon the qualifications of Mr. Birks as a matter of rather great importance.

Mr. DEANS.—It is, very.

Mr. HOLGATE.—And we would like you to make it as clear as possible what your estimate of his qualifications is, with a statement of all the facts in connection with it, that led you to that conclusion. If you want time to prepare that statement——

Mr. DEANS.—I think I can give it to you in a very few words.

Prof. KERRY.—It would be better in the form of record ?

Mr. DEANS.—All right.

Mr. HOLGATE.—We could get that from Mr. Deans at a later date. We would also like you to clearly explain your reasons for making the change from Mr. Hudson to Mr. Birks.

Mr. DEANS.—We never considered the question of leaving Mr. Hudson on the Quebec work longer than the erection of the traveller, and to be certain that it would perform its work, because Mr. Hudson in many ways, was not as well fitted to act as an erection engineer as Mr. Birks. We always had in mind that the permanent engineer on that work should be Mr. Birks. His qualifications were so pronounced that there was no question in our minds about appointing him.

Mr. HOLGATE.—Considering the magnitude of this work, was the question ever considered by you of the appointment as resident engineer of a man who had experience corresponding in some degree to this work ?

Mr. DEANS.—We felt that our interests were perfectly safe in the hands of the force that we had there.

Mr. HOLGATE.—So that that question was not considered?

Mr. DEANS.—That question never entered my mind.

Mr. HOLGATE.—And so far as the Phœnix Bridge Company was concerned, you had full confidence in the men whom you placed in charge?

Mr. DEANS.—I had absolute confidence in the men in charge of that work.

Mr. HOLGATE.—And you would carry that full confidence to the extent of allowing the men there on the work to act in the case of any emergency arising?

Mr. DEANS.—I should expect them to act in the case of any emergency where they did not feel it was necessary to report the matter to the Phœnixville office.

Mr. HOLGATE.—You felt that they were competent to know when an emergency arose?

Mr. DEANS.—Yes, sir, I did.

Mr. HOLGATE. Then, Mr. Deans, was your organization composed and carried out on the assumption that emergencies would arise?

Mr. DEANS.—We expected that they might arise during the construction of that work.

Mr. HOLGATE.—And having that very thought in your mind, you reposed in your staff the confidence you have shown?

Mr. DEANS.—The staff was the best that we could possibly secure, and we had every confidence in them.

Mr. HOLGATE.—If we understand the organization correctly you even then had no man on the work who would act in an emergency or who felt himself competent to act in an emergency without consulting the office in Phœnixville?

Mr. DEANS.—I cannot see how we could have improved on that organization and taken care of an emergency any better except by moving the entire Phœnixville office to the Quebec bridge. In other words, we had a force there that we thought could act in any emergency that might arise, and in which they did not have time to report to the Phœnixville office.

Mr. HOLGATE.—Were telephone communications of frequent occurrence between the bridge and Phœnixville?

Mr. DEANS.—They were of frequent occurrence, and we took special pains with the manager of the telephone at this end and at our end to give us clear and good service between our office and the bridge, but this service was often very poor and very unsatisfactory. The managers at both ends were doing their best to improve it.

Mr. HOLGATE.—What was the first intimation that you received in connection with any trouble reported from the bridge?

Mr. DEANS.—We received daily reports from the bridge which included all matters of interest in connection with the erection. I suppose you refer to our first intimation in connection with any trouble with the chords.

Mr. HOLGATE.—Unless there was anything else?

Mr. DEANS.—There was nothing else of any moment that I remember.

Mr. HOLGATE.—Was the trouble confined to the chords?

Mr. DEANS.—The serious report which we received about chords we received on the morning of the accident.

Mr. HOLGATE.—Had there been intimations of anything of like character before?

Mr. DEANS.—The first report that we received regarding chords which have come up in the investigation here was in a letter dated August 6, which we received August 8. This referred to the fact that one of the centre ribs did not line up in the connection between 7-L and 8-L of the cantilever arm, and contained a suggestion by Mr. Birks to put in a diaphragm at this point. We received word from Mr. Cooper the same day that he had a similar report and that he did not approve of that method, and we had correspondence back and forth, the matter not being settled exactly what would be done at that joint until the day of the accident.

Mr. HOLGATE.—Then what was it decided to do at that joint?

Mr. DEANS.—Nothing was finally decided; it was not considered a matter that demanded immediate attention, and Mr. Cooper had not determined exactly the manner in which he wanted it corrected.

Mr. HOLGATE.—Do I understand, then, that Mr. Cooper disapproved of the suggestion made by, I presume, Mr. Birks?

Mr. DEANS.—Yes, he thought that there might be some better way of holding that rib than that suggested by Mr. Birks.

Mr. HOLGATE.—But up to the 29th of August he had not made up his mind?

Mr. DEANS.—No, the correspondence had not come to a conclusion between our office and the field and his representative in the field and his office.

Mr. HOLGATE.—What position did you take in the matter?

Mr. DEANS.—Mr. Cooper in his correspondence thought that possibly the chord had been bent in either handling or in erection or during transportation. We took the position that no doubt that chord was in exactly the position in which it left Phœnixville, and that it merely was necessary to bring it in line and hold it there, and we thought that Mr. Birks' suggestion was a good one.

Mr. HOLGATE.—Then do we understand that the change took place in that member after it was placed in the bridge?

Mr. DEANS.—I think not. There were a number of other cases similar to this, but not as great in deflection which Mr. Cooper had passed upon and settled himself without any reference to our office.

Mr. HOLGATE.—Previous to this?

Mr. DEANS.—Previous to this, I understand, and possibly subsequent, too.

Mr. HOLGATE.—Were they reported to you by Mr. Birks?

Mr. DEANS.—They were not reported to me by Mr. Birks.

Mr. HOLGATE.—How did you ascertain that?

Mr. DEANS.—I understand that from Mr. McLure.

Mr. HOLGATE.—Were there any other matters reported between August 8 and August 29?

Mr. DEANS.—Nothing of importance?

Mr. HOLGATE.—Until the 29th?

Mr. DEANS.—Until the 29th, in a letter written by the field here on the 27th.

Mr. HOLGATE.—Signed by Mr. Birks?

Mr. DEANS.—Signed by Mr. Yenser, inclosing a letter from Mr. Birks.

Mr. HOLGATE.—We have had information from Mr. McLure in evidence, Mr. Deans, with regard to the subject under discussion on the 27th, 28th and 29th August. Do you remember if that information conveyed by Mr. Birks is substantially the same as has been brought here by Mr. McLure with regard to the condition of the members referred to?

Mr. STUART.—We have copies of the letters.

Mr. HOLGATE.—You have handed in a copy of a letter of August 27 from Mr. Yenser, copy of a letter of August 27 from Mr. Birks, and also copy of a letter from Mr. Birks of August 28. You have the originals in Phœnixville?

Mr. DEANS.—We have the originals in Phœnixville, and these copies were made from the copy-book here.

Mr. HOLGATE.—As to Mr. Yenser's letter in which he speaks of 9-R and L, what have you to say?

Mr. DEANS.—It should be 9-R and 8-R.

Mr. HOLGATE.—You think it is simply an error?

Mr. DEANS.—An error in typewriting.

Mr. HOLGATE.—An error in typewriting?

Mr. DEANS.—His was a typewritten letter.

Mr. HOLGATE.—And Mr. Birks' references are correct in his letter?

Mr. DEANS.—Mr. Birks' references are correct.

(Letters put in, filed, and marked Exhibit No. 58.)

Mr. HOLGATE.—Do you remember what time you received the letters of August 27?

Mr. DEANS.—I think, as I remember, they were received in the usual Quebec mail about 9.20 or 9.30 on Thursday morning, August 29.

Mr. HOLGATE.—When did they come to your attention?

Mr. DEANS.—Immediately on their arrival in the office.

Mr. HOLGATE.—Can you tell us what action you took?

Mr. DEANS.—I immediately called in consultation Mr. P. L. Szlapka, the designing engineer; Mr. William H. Reeves, general superintendent of the company, and Mr. E. L. Edwards, inspector of the Quebec Bridge and Railway Company.

Mr. HOLGATE.—What was the result of the consultation?

Mr. DEANS.—The result of the consultation was that we considered that there was no immediate or possible ultimate danger in that condition, and that we should call up the field and so advise them. I had Mr. Milliken do this over the 'phone about ten o'clock or 10.30, and I heard him from the adjoining room talking to Mr. Yenser on these lines, and when he had finished talking with Mr. Yenser I told Mr. Milliken to call Mr. Birks to the 'phone so that I could talk to him, and I had a conversation with Mr. Birks on the subject.

Mr. HOLGATE.—What was that conversation with Mr. Birks?

Mr. DEANS.—I first asked Mr. Birks if he had made any further examination of the chords, sketches of which were sent in his letter of the 27th. He said: We have been watching it—we have watched it all day yesterday, and there has been no further movement in the chords. He also said that he had examined the lattice and battens, and they showed no signs of yielding, the rivets were tight, and he also said: Since writing you that letter we have made a further examination, which satisfies us that either the entire bend or the whole bend in this chord was in it at the time of erection. We found that the large splice plate which was riveted up in June has shown no signs of movement or action, either in the riveting or the plate since it was erected, and as there had been more than three million pounds added since June he felt entirely satisfied with the condition of the chord, and it was entirely safe to proceed with the erection. He said: We have moved the traveller and have gone on with the erection. I asked him if he had reported this to Mr. Hoare, and he said yes, he had and that Mr. Hoare had been there during the day in which this examination was made.

Mr. HOLGATE.—Were any further instructions given by you to Mr. Birks at that time over the telephone?

Mr. DEANS.—I simply told Mr. Birks to watch the chord, see how it behaved, that we were going to receive a visit from Mr. McLure, that he had seen Mr. Cooper in New York, and then we would decide what was to be done.

Mr. HOLGATE.—Did Mr. Birks, in that conversation, report that he had made any further measurements than those referred to in his letter?

Mr. DEANS.—I assumed that he had made a very careful examination of these chords, because he told me distinctly that there had been no movement in the chords. I assumed that he did something of that sort.

Mr. HOLGATE.—Did Mr. Birks leave any record of any further measurement that he made?

Mr. DEANS.—This letter that he wrote to us, the letter of August 28, is the letter that he referred to.

Mr. HOLGATE.—Is that the last record that Mr. Birks left in regard to these troubles?

Mr. DEANS.—It is the last record that he left regarding these chords.

Mr. HOLGATE.—Were you satisfied, Mr. Deans, with the evidence of Mr. Birks as to the condition of those members when they were placed in the structure?

Mr. DEANS.—I think that Mr. Birks' conclusions as to the condition of that chord when it was placed in the structure grew out of the fact that in all his travels over the bridge he had not noticed it, and the riveting being made in June of a very large plate and showing no signs of working since June.

Mr. HOLGATE.—You refer now to which plate?

Mr. DEANS.—The spliced plate between 8 and 9 L, anchor arm chord. He reached the conclusion that the chord had at least a considerable portion of this wave in the webs when it was erected.

Prof. GALBRAITH.—That was in June?

Mr. DEANS.—June, 1907.

Mr. HOLGATE.—In view of the evidence that we have that Mr. Kinloch, Mr. McLure, and, I think, Mr. Clark, remember the condition of that chord as it was put into the bridge and that Mr. Kinloch, Mr. McLure and Mr. Clark had communicated their knowledge to Mr. Birks, do you think, Mr. Deans, that Mr. Birks' information, as given to you, was correct?

Mr. DEANS.—I think the condition in which that splice was at the time Mr. Birks wrote that letter of August 28, and the fact that it was riveted in June and that 3,000,000 lbs. of material were added, warranted Mr. Birks in believing that he had an actual fact before him to lead him to believe that there was some bend in that chord at the time it was riveted, notwithstanding that these three men thought it was absolutely straight.

Prof. GALBRAITH.—Do you mean 3,000,000 lbs. of material added to the bridge?

Mr. DEANS.—I mean to the bridge. I think he had the right to believe that there was some bend in the chord at the time it was erected.

Prof. KERRY.—Then, as far as you know, Mr. Birks had no positive evidence in reaching his conclusion and his conclusion was based upon argument from the appearance of the chord on the date at which it was riveted.

Mr. DEANS.—Yes, his conclusion, I have no doubt, was reached due to the fact that the spliced plate was riveted at that time; that the bend of the chord extended to the splice, under the spliced plate, and that none of these rivets showed any signs of working since that splice was made, and I think he had no other absolute evidence.

Mr. HOLGATE.—Then, Mr. Deans, in discussing the subject of Mr. Yenser's letter, and of Mr. Birks' two letters with Mr. Szlapka and the others, what considerations weighed with you in deciding you to instruct Mr. Yenser and Mr. Birks as you did?

Mr. DEANS.—Mr. Szlapka took about half to three-quarters of an hour to determine the loading on that chord, and he found that the chord was receiving about three-quarters of its total load. Then, I had Mr. Edwards in to question him in regard to his notes of inspection as to how these chords left the works, and I found that in a number of instances the chords had waves in their webs, but the exact amounts he did not have in his note-book. I also had the general superintendent of the works and he remembered the same facts. We then came to the conclusion that while it was a matter that would ultimately need to be straightened up, the same as other matters, it was not a matter of any immediate serious note, and knowing at that time that we were going to have a conference with Mr. Cooper and Mr. McLure, we waited for our final action until after that. As I remember, that was what was in our minds at the time.

Mr. HOLGATE.—What was the last progress report that you had had from the field prior to the receipt of the letters you have put in—Exhibit No. 58?

Mr. DEANS.—On August 23 and 24 elevations, alignment, position of main post and end post were sent us from the field, and indicated to us that the entire structure was behaving as we expected from our figures and design, and it was so satisfactory and complete that I wrote to the foreman acknowledging the receipt of this report of August 26, three days before the accident, indicating the satisfactory condition in which this entire structure was at that time to our mind. I have the original of that letter here to hand to the Commission.

Mr. HOLGATE.—Would you read the letter and we will put it right in the evidence?

Mr. DEANS (reading):

PHŒNIXVILLE, PA., August 26, 1907.

B. A. YENSER, ESQ.,
New Liverpool, P.Q., Canada.

DEAR SIR.—Referring to your field report No. 19, we know you will be interested in learning the check figures of the office.

The field make the elevation.		Office.
Bottom of P-1,	average 19⅛″	18¾″.
Foot of T-O-O,	average 25 15/16″	24 7/16″.

There must necessarily be some discrepancy between the office figures and the actual facts existing in the field. In the single case of weight of the wooden floor, assumed by the office, at 1,500 lbs. per lin. foot for entire floor, up to and including last panel erected, is no doubt too much, and therefore it is natural that the office results should be lower than the actual figures found in the field. This all is a very satisfactory check.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

P. S.—We will not need any further measurements for longitudinal position until we come to the centre post.—J. S. D.

(Letter put in, filed and marked Exhibit No. 59.)

Mr. HOLGATE.—You say that you expected Mr. McLure on the 29th. What time did he arrive at Phœnixville?

Mr. DEANS.—After our talk with Mr. Yenser and Mr. Birks over the 'phone on the morning of August 29, at about 10.30, I went to Philadelphia on the 11.09 train and returned to Phœnixville about three o'clock. Either then, or immediately thereafter, I received a message from Mr. Cooper's office advising me that Mr. McLure would be at our office at five o'clock. I then advised Mr. Szlapka, the designing engineer, and Mr. Milliken, superintendent of erection, to come into the office and await Mr. McLure's arrival. He reached there at five o'clock and reported his meeting with Mr. Cooper, and I asked him if Mr. Cooper had given him any further instructions, and he said no; he evidently wanted to look into the matter further. I asked him if he made any figures over there, and he said no, there was not time.

Prof. GALBRAITH.—If he had made any figures?

Mr. DEANS.—Any calculations.

Prof. GALBRAITH.—If Mr. Cooper had done so?

Mr. DEANS.—He said no, there was not time; he had just told him to go to Phœnixville.

Mr. HOLGATE.—Up to that point had there been any communication between Mr. Cooper and Phœnixville that day?

Mr. DEANS.—Just that message—the message that Mr. McLure has put in exactly—I have not a copy—advising us that Mr. McLure would be there.

Mr. HOLGATE.—There was no telephonic communication?

Mr. DEANS.—No telephones, no other messages and no letter.

Mr. HOLGATE.—Yes?

Mr. DEANS.—In this discussion Mr. McLure said that he had received a message from Mr. Birks advising that he had made further investigation of the chords and referring to a letter which he had written which would reach Phœnixville on Friday morning. Our discussion was stopped probably quicker than it otherwise would have been to await the receipt of that letter.

Mr. HOLGATE.—Is that letter in evidence?

Mr. DEANS.—It is dated August 28.

Mr. HOLGATE.—And it forms part of Exhibit No. 58?

Mr. DEANS.—Yes, sir. Mr. McLure left the office, I think, about half-past five, and fifteen minutes after he left we had a call from Quebec which we could not understand well, and it took Mr. Waitneight with all his efforts at this end and our efforts, through the manager of the telephone company at our end, to get any word from Quebec up to about, as I remember it, ten minutes after seven from a quarter of six. That is when we were advised of the wreck.

Prof. GALBRAITH.—From a quarter past five?

Mr. DEANS.—We had a call from Quebec about a quarter of six. It was so poor that Mr. Milliken, who went to the 'phone, could not understand what was said. Mr. Waitneight tried, and as he was not able to get the connection, I called up the manager from our end to try and get the connection, and it took till ten minutes after seven to get word, as I remember it.

Mr. HOLGATE.—In the conference after Mr. McLure arrived did you arrive at any conclusion?

Mr. DEANS.—No, sir, the discussion was not completed.

Prof. GALBRAITH.—You were expecting this letter?

Mr. DEANS.—Expecting this other letter which would contain some important information next morning.

Mr. HOLGATE.—Has there been any communication from Mr. Cooper to the Phœnix Bridge Company since the occurrence of this accident?

Mr. DEANS.—No communication whatever.

Mr. HOLGATE.—Has there been any communication at all from Mr. Cooper bearing upon these features?

Mr. DEANS.—No communication. These (referring to three bundles of blue prints) are Mr. Birks' own notes.

Mr. HOLGATE.—Will you put that in, and say in your own words what it is?

Mr. DEANS.—The small blue print note-book entitled 'Notes for erecting Quebec Bridge,' containing 77 pages, and also blue print (pages 1 to 5), being notes covering erection of main traveller, are notes covering all details of erection, and were those used by Mr. Birks, erection engineer.

Mr. HOLGATE.—Do I understand that this is the actual copy used by Mr. Birks?

Mr. DEANS.—This is the actual copy used by Mr. Birks on the work. These were the instructions issued from the Phœnixville office for erection purposes.

(Blue prints put in, filed and marked Exhibit No. 60.)

Witness retired.

Mr. MILLIKEN re-called.

Mr. HOLGATE.—We asked you, Mr. Milliken, for a statement indicating the condition of each riveted joint as it existed on August 29. Have you been able to get that?

Mr. MILLIKEN. This (producing paper) is a statement showing the condition of the field riveting up to August 29, on the anchor and cantilever arms.

Mr. HOLGATE.—And in so far as you know, it is complete?

Mr. MILLIKEN.—Yes, sir; that is prepared by Mr. Kinloch and Mr. McLure and, in so far as I know, it is complete.

Mr. HOLGATE.—You have been over it?

Mr. MILLIKEN.—Yes, sir.

Mr. HOLGATE.—And from your knowledge of the work you believe it to be correct?

Mr. MILLIKEN.—Yes, sir.

Witness retired.

Mr. McLURE recalled.

Mr. HOLGATE.—Are you familiar with the document that Mr. Milliken has just put in?

Mr. McLURE.—Yes, I made it out.

Mr. HOLGATE.—And it is correct?

Mr. McLURE.—In so far as I know it is; to the best of my knowledge, it is correct.

Mr. HOLGATE.—Is this the best information that is available at the present time on this point?

Mr. McLURE.—It is the best information that is available, unless Mr. Kinloch knows of some correction to add to that.

Witness retired.

Mr. KINLOCH recalled.

Mr. HOLGATE.—Are you familiar with the statement put in by Mr. Milliken in regard to the condition of the riveting on August 29?

Mr. KINLOCH.—Yes, sir.

Mr. HOLGATE.—Is it correct?

Mr. KINLOCH.—Yes, to the best of my knowledge.

Mr. HOLGATE.—Is there any means of getting more accurate information than this statement contains?

Mr. KINLOCH.—No, sir.

(Statement put in, filed and marked Exhibit No. 61.)

Witness retired.

Mr. MILLIKEN recalled.

Mr. HOLGATE.—Mr. Milliken, have you the information that we asked for that would indicate the position of the locomotive and the cars, the traveller and any material for erection, or any material to be erected, that was on the cantilever span on August 29?

Mr. MILLIKEN.—I have information gained from those who were at the bridge or on the bridge on August 29.

Mr. HOLGATE.—Do you believe it to be correct?

Mr. MILLIKEN.—Yes, sir.

Mr. HOLGATE.—Could you compile that and put it on a diagram so that we can understand the actual location of these weights?

Mr. MILLIKEN.—Yes, sir.

Mr. HOLGATE.—Will you do so?

Mr. MILLIKEN.—Yes, sir.

Mr. HOLGATE.—I thought it would be in time if we had that in complete form when we were discussing the matter with Mr. Szlapka.

Mr. MILLIKEN.—All right, sir, I will get it in more complete form by that time.

Mr. HOLGATE.—Are there some other matters that you want to bring up?

Mr. MILLIKEN.—Nothing except the shell that was damaged in the wreck on the Delaware and Hudson Railway.

Mr. HOLGATE.—Will you explain what the shell is?

Mr. MILLIKEN.—It is the shell or shield covering the bars on the anchor pier.

Mr. HOLGATE.—As part of the framework of the structure?

Mr. MILLIKEN.—No, sir, entirely independent.

Mr. HOLGATE.—So that the accident that you refer to could have no effect on the structure itself?

Mr. MILLIKEN.—None whatever. It is just simply a shell covering the anchor bars, and is rather an ornament to the end of the bridge.

Prof. GALBRAITH.—An architectural feature and not an engineering one?

Mr. MILLIKEN.—Yes, sir.

Prof. GALBRAITH.—You might say what the accident was.

Mr. MILLIKEN.—It was simply the bending of one or two panels of the lacing between the plates that comprised the shell.

Mr. HOLGATE.—As a matter of fact, were they repaired before it was used in the bridge?

Mr. MILLIKEN.—Yes, sir. I have some correspondence in connection with the accident to the shell, copies of which I will leave with the Commission.

Mr. HOLGATE.—Are there any other correspondence or letters you have bearing on the accident?

Mr. MILLIKEN.—No, sir.

Mr. HOLGATE.—We would like to go through that letter-book between the office and the bridge and see if there is anything there of interest, Mr. Stuart.

Mr. STUART.—We will hand it to you. I do not want to deposit it for reasons I have already explained, but if there are any letters you wish to be put in we will put them in. Mr. Deans is at the hotel, and he will hand it to you.

Witness (Mr. Milliken) retired.

Mr. CUDWORTH recalled.

Mr. HOLGATE.—We asked you for some information yesterday, Mr. Cudworth. You might just put in as Exhibit No. 62 those three papers (referring to papers produced by Mr. Cudworth), and describe what they are.

Mr. CUDWORTH.—The first sheet is a sketch showing the method used in measuring between the anchor pier and main pier south anchor arm on September 17, 1907. The next sheet is a plan showing the location of the 24-inch pins on September 27, 1905. The third is a photograph showing the progress of erection at the close of the season of 1906.

(Sketch, plan and photograph put in, filed and marked Exhibit No. 62.)

Prof. GALBRAITH.—I think you were asked to make a statement regarding the delicacy of your instruments on this work. You are going to get that?

Mr. CUDWORTH.—Yes, sir. I also put in additional wind records to be added to those already deposited and marked Exhibit No. 56.

Witness retired.

Mr. HOARE, recalled.

Mr. HOLGATE.—In going over the evidence from yourself, we thought we came across some inconsistencies, and having spoken about these matters, and having suggested to you to read your own evidence over again and that some other matters would probably appear to yourself, we would like to know what you have to say in regard to those points that were brought up, and if you would just make a statement covering any matters that may appear somewhat inconsistent in your evidence, we would be glad to have it.

Mr. HOARE.—I found on further examination that I had made certain misstatements as to dates—what I did on certain dates previous to the accident. Having referred to certain notes and having further referred to the matter, I have put the facts, which I think are quite accurate, in writing. May I read it?

Mr. HOLGATE.—Kindly read it?

Mr. HOARE (reading).—The first information of the deflection in chord A-9-L was received by me on Tuesday evening, when Mr. McLure called at my house with a sketch of chord A-9-L anchor arm.

I thought the matter important, but not serious, and gave instructions that a thorough examination of the bridge should be made—particularly all chords, posts, laterals and main pier, and to take levels to the main pier.

On Wednesday morning I went out to the bridge, and Mr. McLure and Mr. Kinloch reported that they had examined all the chords, Mr. McLure the upper ones and Mr. Kinloch the lower ones, and that none of them showed any departure from the normal except A-9-L anchor arm and 8 and 9 cantilever arm, and that no change had taken place in any of these. They further reported to me that the lacing on A-9-L was not otherwise affected than being strained, when tested with a hammer—that the posts were in perfect order and showed no sign of strain—that the diagonals were normal. I also asked if they were certain that all other chords were in line and if any lower laterals were deflected or showed signs of anything being wrong at connections with chords. Mr. Kinloch replied that he had inspected those parts, and that everything was O.K.

It was also reported to me that the levels of the bridge had been taken by Mr. Cudworth and that these levels were in exact accord with the theoretical calculations as to what their position would be when carrying its then load.

These facts satisfied me that there was no real danger, and in fact the idea of danger did not enter my head.

I thought the matter important, as possibly requiring repair, and inviting possible delay, but the idea of a possible collapse of the bridge never crossed my mind.

I have been asked to give an exact statement of my movements from Monday the 26th to Thursday the 29th of August, inclusive. After the most careful thought and examining all records which I could lay my hands upon, I find the following to be the facts:

Monday, August 26.—In office at Quebec.—Called McLure on the telephone to know what was taking place at bridge. Answer received that on account of scarcity of men there was no erection that day. In the afternoon I went to Cap Rouge.

Tuesday, August 27.—In office all day preparing for annual meeting. McLure called me on the telephone at 4.30 p.m. to say that he would see me that evening, as he had something special to discuss.

Wednesday, August 28.—I spent all day at the bridge, arriving about 10 to 10.30 a.m., leaving there at about 4.30 p.m., when it was reported to me before leaving that no change whatever had taken place in chord A-9-L nor in any part of the bridge. I felt no anxiety about the bridge.

Thursday, August 29.—I was in the office until 1 p.m. I went out to Cap Rouge and spent the afternoon there. I reached home about 6 p.m, when I heard of the fall of the bridge. During the afternoon I received the telegram from Mr. Deans that the bend in chord was of long standing, which somewhat strengthened my confidence.

Mr. STUART.—I think Mr. Hoare ought to add there that that was a misunderstanding on his part and that the chord referred to was the chord in the cantilever arm.

Mr. HOARE.—This telegram is already in evidence. I did not understand that it referred to the other chord until he came here.

In answer to Mr. Kerry respecting events that happened on the 20th of August, Mr. Kinloch called me up about 9 a.m. to say that no work was in progress on account of a man being killed, and wished me to convey the information to Mr. McLure at the hospital and tell him not to worry about getting to the work that day. Mr. Kerry asked me to especially account for what took place on the 20th, and at the time of my evidence yesterday I was rather vague about it.

Mr. HOLGATE.—You stated in evidence yesterday that you did not personally examine chord No. 9-L. Have you any explanation to account for this?

Mr. HOARE.—Having full confidence in Messrs. McLure and Kinloch, I depended entirely upon their investigation and measurements in all matters of that kind. To personally reach that chord it would be a great physical effort attended by a considerable amount of danger, unless one was in daily practice in doing that kind of work. The inspectors were there for that special purpose, and if I had to climb to look at

every detail on the bridge I might just as well have been an inspector myself and their services would not have been necessary. My work was more general in looking after the company's business and seeing that the work was being carried out according to contract and specifications and that inspectors on the work and at Phœnixville were fulfilling their various duties from time to time and giving me the necessary information required for the proper conduct of the work and for its monthly estimation for progress payments.

Mr. HOLGATE.—Were these progress payments made upon your certificate, Mr. Hoare?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—Was there any inspection on the part of any other authority before these certificates were made payable?

Mr. HOARE.—A Mr. Tomney represented the government at Phœnixville.

Mr. HOLGATE.—Who represented the government at the Quebec bridge?

Mr. HOARE.—Mr. Johnston.

Mr. HOLGATE.—All I want to know is whether Mr. Tomney's and Mr. Johnston's certificates were required to make your certificates payable, that is the only point I want.

Mr. HOARE.—No, they did not come to me; their certificates were necessary for the Dominion government to check mine.

Mr. HOLGATE.—Their certificates were necessary for payment to the Phœnix Bridge Company?

Mr. HOARE.—Yes, sir.

Mr. HOLGATE.—That is the way you understand it?

Mr. HOARE.—All right.

The Commission adjourned to meet in Ottawa on Thursday, September 26.

SUPPLEMENT TO MR. DEAN'S TESTIMONY.

QUEBEC, Sept. 27, 1907.

Mr. Deans, by direction of the Commission, dictated the following general description of the methods adopted in the designing and erection of the Quebec Bridge, to be considered as an addition to his sworn testimony:

Study.—When the construction of this bridge was first considered in detail it was soon appreciated that the erection would be by far the most important item of construction, and that upon the success of this feature of the construction the safe execution of the work would be dependent. In this connection studies were made of what had been done in the past in the erection of cantilever construction and after careful consideration it was decided that a departure from the plans pursued in previous works was necessary to ensure absolute safety. The preliminary studies and preparation of these plans engaged the labour of eight to ten engineers and draughtsmen for the greater portion of three years.

Shop Details.—In designing the details of the structure all connections and field details were designed to facilitate the erection and to ensure safety in this part of the work. This feature was carried out without regard to the shop cost, it being thoroughly appreciated that cost must not enter into this consideration. To this end, double pin connections were made at panel points and the riveted connections were so arranged as to make it possible to complete a panel in its entirety before proceeding to the erection of the next panel. Details were so arranged that as each panel was

completed the bracing, both upper and lower horizontal bracing and the transverse bracing could be put in complete.

False work.—The anchor arm span, 500 feet long, about 96 feet deep at the shore end and 315 feet deep at the main pier, being a frame with its long members, at the time of its erection materially different in length from what they would be in the finally completed structure, made it necessary to erect this anchor span as a frame broken at principal joints. To make the erection of this frame possible it was necessary to set it upon false work that would not settle appreciably under load and that would make the jacking of pin centres to fixed points easily possible. This consideration, in addition to the further consideration of avoiding all risk of accident by fire, decided us to adopt steel false work to support the metal superstructure. The only wooden false work used being the central portion, temporarily required to carry stringers and tracks for the running out of material and metal for erection. This steel false work was founded upon a grillage of three to five layers of heavy planed timbers set to exact levels by instrument. Before placing these timbers we had the foundation examined by expert foundation engineers. The care exercised in the placing of these foundations led to excellent results, no settlement of any magnitude occurring during the erection of the anchor span. Immediately under the lower chord at panel points steel blocking was placed, resting on the top of the false work, and this blocking was so designed that the panel point could easily be raised or lowered by means of jacks. The blocking was also arranged so that movement longitudinally for temperature changes, etc., might readily take place, without distorting the trusses.

Travellers.—The principal departure from previous practice was in the style of the traveller. In the past engineers have used what is called an inside traveller running between the trusses and resting directly upon the floor system. This style traveller prevented the complete erection of each panel including the bracing, before the traveller is moved ahead. For this very important reason the traveller used at Quebec is what is called an outside traveller, completely enveloping the entire frame work and resting upon the false work during the erection of the anchor arm and upon extended contilevers of beams hung from lower chord pins, during the erection of the cantilever arm. This style of traveller, while much more expensive, made it possible to complete each panel in order, including all bracing, insuring absolute safety. For the erection of the suspended span a smaller traveller running upon the top chords of the span was used. This traveller also permitted the complete panel to be finished before moving ahead. The rigging of the traveller called for hoisting blocks, sheaves, shackles and engines far beyond what had been used before and actual tests of all of these features were made and all were carefully designed in our engineering office. The travellers themselves were designed and figured with the same care as the permanent structure and also received the same careful inspection in the shops and the same high grade of material was used in their construction.

Power.—Careful consideration was given to the power to be used and it was finally decided to adopt electric power. This reduced the risk of fire and also was considered more reliable in view of the erection running into the winter at the end of the season. The electric power was used not only for the four 125 horse-power hoists on the main traveller and the two 55 horse-power hoists on the smaller traveller, but for all other engines used on the structure, and it was also used to run compressors for riveting, reaming, drilling, &c., eliminating the use of fire upon the entire structure, with the exception of rivet-heating forges. This electric power was used more extensively in this structure than in any previous work and demonstrated its superiority over steam. The electric power was obtained from the Canadian Electric Company—it being delivered at a substation at bridge in 2,200 volt alternating current and then transformed by 175 k.w. generators to 550 volt direct current for use in motors on the structure.

Erection appliances.—The magnitude of the work and the size of the members, running as they did, up to 100 tons, made it impossible to use the ordinary methods

of handling, and, therefore, we designed in advance erection appliances for the handling of all members, with complete plate, angle, and pin connections with the hoisting block shackles. These appliances received not only the consideration of the erection department, but were carefully checked up by the designing department and not a single one developed any sign of weakness during the erection of the work.

Storage yards.—To ensure continuous erection and avoid any delays incident to wrecks in transit, &c., storage yards were established near each end of the bridge. These yards were 67 feet wide and about 1,000 long, served by two 65 horse-power electric cranes. These storage yards were capable of holding about 12,000 tons of material and also afforded sufficient room for assembling eye bars in complete panels ready for erection and also for the attachment of appliances to other members in advance of their being forwarded to the bridge.

Erection programme.—To eliminate as far as possible the necessity of the erection foreman using his judgment in connection with the erection, a programme was made out in the office a year or so in advance of the actual work being done and was made out by the erection department, working in conjunction with the engineering department, fixing in every detail, every operation of the traveller and the hoisting apparatus, and defining to the minutest detail how the attachments should be placed and attached, and how the material should be loaded on the cars at the storage yards. This programme also gave in detail the sets of hoisting falls which should be attached in handling each member, how each member should be raised from the car and how it should be lowered into place and connected. All of this programme was indicated in clear terms in blue prints, furnished to the general foreman, assistant foremen and engineers. These instructions covered every operation from the placing of the first member to the completion of the entire work, and it included every member on the bridge. It is a matter of the greatst interest to know that this programme was found to work perfectly and with the experience gained on the south side, very few and only minor alterations were made in connection with the work on the north side.

Special features.—Deflection diagrams and diagrams giving the position of all pin points, alignment, position of main and end posts were made by the field engineer and records sent to the office at Phœnixville, and to the consulting engineer, and after the moving of the traveller from panel point to panel point, during the entire work. A United States weather bureau standard wind gauge with electric registering apparatus in the office was used to keep a daily record of wind velocities. Thermometer readings were also taken and records each day. The movement of the trusses under varying degrees of temperature were also noted and recorded.

Field organization.—In addition to the regular field erection force which consisted of a general foreman in charge of the entire work, assistant foremen at the travellers and storage yards and in charge of riveters and false work, two engineers of special fitness for their work were kept at the bridge during the entire construction, one engineer having full charge of all instrument work and one engineer having whole charge of all matters in connection with the power assembling and handling of members, the proper attachment of all appliances, the proper bolting and riveting of all joints, including bracing. Both of these engineers were technical advisers to the general foreman. There was also a master mechanic (Mr. Samuel Oaks, who survived) on the work at all times and an electrician (Mr. Britton).

Results.—The first metal was placed in position on the anchor pier July 22, 1905. From that date to August 29, 1907, not a single accident of any kind occurred to the hoisting apparatus or in the handling of any material to the bridge or in erecting it in place. There were only five fatal casualties during the entire time, and each of these casualties was the result of the individual action of the man.

FIFTEENTH DAY.

OTTAWA, Sept. 26, 1907.

The Commission met in Room 16, House of Commons, at 3 p.m.

Mr. COLLINGWOOD SCHREIBER, C.M.G., sworn.

Mr. HOLGATE.—Up to what time were you Deputy Minister and Chief Engineer of the Department of Railways and Canals?

Mr. SCHREIBER.—What time did I cease to be?

Mr. HOLGATE.—Yes.

Mr. SCHREIBER.—On the 1st July, 1905.

Mr. HOLGATE.—How long did you occupy that position up to that time?

Mr. SCHREIBER.—Since December, 1892, I think it was or 1893. It was 1892. I think.

Mr. HOLGATE.—You would be familiar with all the business that was done in connection with the Quebec bridge?

Mr. SCHREIBER.—It all passed through my hands.

Mr. HOLGATE.—We would like to have just a concise story of the connection of your department with the Quebec bridge. You could just give us that and then, at the proper places, put in any documents that will illustrate the matter. Then we can follow it through consecutively in the evidence.

Mr. SCHREIBER.—You wish to begin from the approval of the plans?

Mr. HOLGATE.—Yes, from the inception of the idea.

Mr. SCHREIBER.—The general plan of the bridge was approved by order in council of May 16, 1898. (Referring to Exhibit No. 2).

Mr. HOLGATE.—What necessitated the approval by order in council at that time, Mr. Schreiber?

Mr. SCHREIBER.—The government had granted a subsidy to the bridge of a million dollars.

Mr. HOLGATE.—Do you remember the date of the grant of the subsidy?

Mr. SCHREIBER.—No, I do not.

Mr. HOLGATE.—At any rate the granting of the subsidy then was previous to the submission of the plan for the location of the bridge?

Mr. SCHREIBER.—So far as the location is concerned, that is a matter that affects the navigation of the river and for that reason the plan would have to be approved; that is the general plan. That is one reason, and other is, as I say, in regard to the subsidy.

Mr. HOLGATE.—After the approval of the location under the order in council, what was the next matter that came up?

Mr. SCHREIBER.—Then a contract was entered into under the Subsidy Act and the work proceeded. Month by month I had it examined by an engineer to see what quantity of work had been done and the value of the work upon which the subsidy was based, and on my certificate the payments were made for subsidy.

Mr. HOLGATE.—Did the Quebec Bridge Company submit to you their general specifications?

Mr. SCHREIBER.—I think so, yes.

Mr. HOLGATE.—Was that in the same year, 1898?

Mr. SCHREIBER.—I think they submitted one in 1903—I am not sure, but I think so. They certainly did when they entered into that contract in 1898.

Mr. HOLGATE.—I have a note here that on Aug. 31, 1898, you advised the Quebec Bridge Company that their general specification was approved of?

Mr. SCHREIBER.—Yes, that is dated the 31st Aug. 1898 (referring to Exhibit No. 5). That is correct and I informed them that the specification was quite satisfactory.

Mr. HOLGATE.—Why was that approval necessary?

Mr. SCHREIBER.—So as to ensure a bridge of sufficient strength, giving the height above water, &c., and specifying the class of masonry that the abutments were to be built of, also the character of the steel of which the superstructure was to be built.

Mr. HOLGATE.—Under what general act of legislation was this approval necessary?

Mr. SCHREIBER.—All bridges at that time had to be approved by the Railway Committee of the Privy Council and now they have to be approved by the Railway Commission.

Mr. HOLGATE.—Then, these general specifications being approved, what was the next step?

Mr. SCHREIBER.—The contract was prepared and executed and the work proceeded.

Prof. KERRY.—This approval that we have here is not an approval by the Railway Committee, it is approval by the chief engineer of the department.

Mr. SCHREIBER.—I approve and recommend them.

Prof. KERRY.—What we are trying to get at is under what special legislative authority was this approval made. Why was it necessary? Was it part of the regular business of the Railway Committee of the Privy Council?

Mr. SCHREIBER.—I should say that the approval of plans is a part of the business of the Railway Committee of the Privy Council, and this approval, I think, is called for by the Act or by the contract in some way or other—by the contract, I think it is —may be it provides in the contract that it shall be approved before the work proceeds.

Mr. HOLGATE.—Who prepared the specifications that were approved?

Mr. SCHREIBER.—I understood Mr. Cooper did, and Mr. Cooper states so, I think, in a letter of his.

Mr. HOLGATE.—I refer to the specifications that are approved by your letter of Aug. 31, 1898, Mr. Schreiber?

Mr. SCHREIBER.—I do not remember who did that.

Mr. HOLGATE.—In a resolution of the board of directors of the Quebec Bridge Co., Mr. Hoare appears to have been instructed to put himself in communication with you in connection with preparing suitable specifications for the proposed Quebec bridge to be a basis for calling for tenders. Do you recollect if that was the course pursued?

Mr. SCHREIBER.—I do not remember that, but my impression is that when they advertised for tenders they asked the companies to submit their specifications and plans giving a certain basis upon which they were to work.

Mr. HOLGATE.—We would like to find out just how these specifications were arrived at and who drew them up. They were approved by the chief engineer of the Department of Railways and Canals?

Mr. SCHREIBER.—That is right.

Mr. HOLGATE.—But what specifications were they and who prepared them?

Mr. SCHREIBER.—What is the date of that? (referring to Exhibit No. 5.)

Mr. HOLGATE.—1898.

Mr. SCHREIBER.—Those must have been submitted by the company. It is quite probable that Mr. Hoare had a consultation with me about them. It is very likely.

Mr. HOLGATE.—Would you not have a record of those specifications?

Mr. SCHREIBER.—There should be. There must be one in the department.

Mr. HOLGATE.—But you cannot now say what specifications they were or who prepared them?

Mr. SCHREIBER.—I looked over some correspondence this morning and there were no specifications attached to the copy of the contract that I saw there, but the contract referred to the specifications.

Mr. HOLGATE.—What contract would that be?

Mr. SCHREIBER.—The contract of 1898, I think.

Mr. HOLGATE.—Is that the subsidy agreement?

Mr. SCHREIBER.—Yes.

Mr. HOLGATE.—That is at a later date?

Mr. SCHREIBER.—Was it? Was that the one of 1903?

Mr. HOLGATE.—Yes, we are only at 1898 now.

Prof. KERRY.—Mr. Schreiber, before the approval of this first set of specifications was given by you what investigation was made into the specifications themselves as to their soundness and to their being satisfactory for the work in contemplation?

Mr. SCHREIBER.—I am speaking from memory now, but I should judge from my usual practice that I must have been in consultation with Mr. R. C. Douglas, our bridge engineer. That is the usual practice.

Prof. KERRY.—Then their specifications would have been referred to Mr. Douglas to examine and report on?

Mr. SCHREIBER.—Yes.

Prof. KERRY.—And would have been approved by you after he had passed them as being satisfactory?

Mr. SCHREIBER.—Yes.

Mr. HOLGATE.—Then, we understand, the history of the matter was that the Quebec Bridge and Railway Company issued a circular letter inviting tenders?

Mr. SCHREIBER.—Yes.

Mr. HOLGATE.—Then that certain tenders were sent in and a period of time elapsed and the next thing we hear about in connection with the department was an agreement between the Quebec Bridge and Railway Company and the government dated November 12, 1900 (Exhibit 12). There are certain specifications attached to that contract?

Mr. SCHREIBER.—Yes, there must be a general specification.

Mr. HOLGATE.—Can you say who prepared those specifications?

Mr. SCHREIBER.—My impression is that they were prepared by the Phœnix Bridge Company; I am not sure. I forget when Mr. Cooper was appointed. Mr. Cooper was a man we relied on very much for these things and I forget when he was appointed, whether it was under the second contract, that contract for the guarantee, or whether it was——

Mr. HOLGATE.—Mr. Cooper, it appears, came into the question in May, 1900.

Mr. SCHREIBER.—It is perfectly evident that he did not prepare the 1898 one; that is sure.

Mr. HOLGATE.—No, sir, he is not connected with the matter in 1898.

Mr. SCHREIBER.—No, I really could not tell you now who did prepare those.

Mr. HOLGATE.—What was Mr. Cooper's position as you understood it?

Mr. SCHREIBER.—He was consulting engineer to the company.

Mr. HOLGATE.—To what company?

Mr. SCHREIBER.—To the Quebec Bridge and Railway Company—not to the Phœnix Bridge Company.

Mr. HOLGATE.—Did he hold any other apopintment to your knowledge in connection with the matter?

Mr. SCHREIBER.—Not that I am aware of—just consulting engineer.

Mr. HOLGATE.—Acting solely for?

Mr. SCHREIBER.—Solely for the company.

Mr. HOLGATE.—The Quebec Bridge and Railway Company?

Mr. SCHREIBER.—Yes, solely for the Quebec Bridge and Railway Company and being an engineer of very high repute, of large experience in bridge construction and known as the leading bridge engineer in the United States we relied largely on him, the interests of the bridge company and the government being really identical.

Mr. HOLGATE.—The agreement between the Quebec Bridge Company and the government being made in November had you come in contact with Mr. Cooper in connection with the matter prior to that time?

Mr. SCHREIBER.—Prior to 1898?

Mr. HOLGATE.—Prior to Nov. 12, 1900. Mr. Cooper made a report on the plans and specifications?

Mr. SCHREIBER.—No, I did not know Mr. Cooper till then. I only knew him by repute, but I had never seen him. When I say we relied on Mr. Cooper, I mean as to general things, but all detailed drawings and so forth were placed before Mr. Douglas to see whether the strains exceeded any of those in the specification so that everything went through his hands before it was passed.

Mr. HOLGATE.—Were those specifications attached to Exhibit 12, sufficient?

Mr. SCHREIBER.—I do not understand your question.

Mr. HOLGATE.—I will put it in another way. Were the specifications attached to the subsidy contract the same as those that were prepared in 1898, before referred to, and approved by your letter in Exhibit 5?

Mr. SCHREIBER.—I think so. I do not remember others.

Mr. HOLGATE.—Were they considered sufficient then for the work under contract?

Mr. SCHREIBER.—They were considered so.

Mr. HOLGATE.—Clause 2 of the subsidy agreement, Exhibit 12, stipulates that the company shall build the bridge in accordance with the general plans before mentioned and the specification for substructure and superstructure hereto annexed marked respectively 'A' and 'A-1' or with such amendments of the said plans and specifications as the Governor General in Council may from time to time approve. Were there amendments to these specifications?

Mr. SCHREIBER.—There evidently were amendments to the specifications, because I see a letter here from Mr. Cooper in which he refers to some amendments he proposes. I do not know whether you have seen that letter or not, here is a copy of it.

(Mr. Schreiber here produced a copy of a sheet in Exhibit 21, marked 21-A.)

Mr. HOLGATE.—Were there any details attached to that, Mr. Schreiber, or is that all you have in connection with that matter?

(Mr. Schreiber filed copies of a letter from Mr. R. C. Douglas, bridge engineer of the Department of Railways and Canals, criticising the amendments to these specifications proposed by Mr. Theodore Cooper. These documents were filed and marked Exhibit 63 on the understanding that they would be later further identified by sub-numbers.)

Prof KERRY.—This subsidy agreement provides that the bridge was to be constructed in accordance with the specifications attached to the agreement, or with such amendments to the said plans and specifications as the Governor General in Council may from time to time approve. Do you know if any amendments to the specification were approved by the Governor General in Council?

Mr. SCHREIBER.—I am not aware of any, and I should judge by those reports of Mr. Douglas that there would not be, for I see he has reported against these proposed changes of Mr. Cooper's. There was no order in council approving of any changes but they made me responsible for that, and in consultation with Mr. Cooper if there were any changes that I approved I passed them through, but in passing through, I would pass nothing through without first putting it through the hands of our bridge engineer, Mr. R. C. Douglas.

Mr. HOLGATE.—Then have you a record of the changes in specifications that were approved by you?

Mr. SCHREIBER.—I could not see any in the correspondence I looked through to-day in the department.

Mr. HOLGATE.—In connection with that matter, you have just put in certain papers purporting to be modifications in the specifications (Exhibit 63); were they approved by you?

Mr. SCHREIBER.—I am afraid I am not able to say at this moment; nothing was approved by me that Mr. Douglas, after going through the figures, would recommend should not be approved.

Mr. HOLGATE.—Where would we ascertain whether Mr. Douglas did pass these or not?

Mr. SCHREIBER.—It ought to be in the correspondence, in letters to me, correspondence with me.

Mr. HOLGATE.—To what extent was your department then interested in having the specifications for the construction of the bridge approved, Mr. Schreiber?

Mr. SCHREIBER.—They were paying the subsidy upon this and later on they were guaranteeing the bonds of the company.

Mr. HOLGATE.—Up to that time they had not guaranteed the bonds of the company?

Mr. SCHREIBER.—No, but up to that time they were paying subsidy and they wanted to ensure having a substantial, safe structure built, and not pay out their money for nothing.

Mr. HOLGATE.—The approval of the specifications must have taken place some time or else the construction would not have been proceeded with.

Mr. SCHREIBER.—Oh, no doubt it must have been, no doubt.

Mr. HOLGATE.—In your recommendation to Council, Mr. Schreiber, of the 9th of July, 1903, you ask to be authorized to employ a competent bridge engineer?

Mr. SCHREIBER.—Yes.

Mr. HOLGATE.—To examine from time to time the detail drawings of each part of the bridge as prepared?

Mr. SCHREIBER.—Yes.

Mr. HOLGATE.—Was your recommendation followed?

Mr. SCHREIBER.—There was an order in council passed upon that recommendation authorizing that to be done.

Mr. HOLGATE.—And what was the result?

Mr. SCHREIBER.—And the department corresponded with an engineer of the name of Nichols in New York, asking what terms Mr. Nichols would make. Mr. Nichols was a man of some standing in the profession and he gave his terms, &c. In the meantime, I wrote to Mr. Cooper and I enclosed him a copy of the order in council, &c., and he replied not favouring that very much. He said it would take the responsibility off his shoulders. After that I think the matter went into the minister's hands and he wrote something. I forget now exactly what that was. However, it resulted in this, that after discussing the matter it was considered that the interests of the company and of the Dominion government were identical in every way, and therefore, having Mr. Cooper, a man whose ability was never questioned, and whose experience in connection with bridge construction has been large, it was thought better to rely upon him rather than interfere with what he might do, what advice he might give.

Mr. HOLGATE.—Then we gather, Mr. Schreiber, that you acted in accordance with that, and that really in the design Mr. Cooper for those reasons was given a free hand?

Mr. SCHREIBER.—Yes, he was.

Mr. HOLGATE.—Were you familiar with the modifications in the specifications, that Mr. Cooper made?

Mr. SCHREIBER.—No further than they came before me and I would hand them over to Mr. Douglas. I do not remember what they were now, you know, and I think Mr. Douglas reported in favour of many of them. I do not know that he did all, and then if he did not, they were not approved.

Mr. HOLGATE.—Could we find what points were disapproved by your department?

Mr. SCHREIBER.—I think by searching through the correspondence in the department that might be ascertained.

Mr. HOLGATE.—Could Mr. Douglas tell us?

Mr. SCHREIBER.—Yes, he could; yes, I think so.

Prof. KERRY.—The Order in Council of August 15, 1903, Exhibit 18, read as follows, Mr. Schreiber;—

'The minister further represents that the chief engineer has this day reported stating that, as the result of the personal interview had with the company's engineer, he would advise that, provided the efficiency of the structure be fully maintained up to that defined in the original specifications attached to the company's contract, the new loadings proposed by their consulting engineer be accepted; all detail parts of the structure to be, however, as efficient for their particular function as the main members for theirs, the efficiency of all such details to be determined by the principles governing the best modern practice, and by the experience gained through actual test; all plans to be submitted to the chief engineer, and until his approval has been given, not to be adopted for the work.

'The minister recommends that authority be given for following the course so advised by the chief engineer, the order in council of the 21st July last to be modified accordingly.'

Now, that order in council of that date would seem to authorize the adoption of the new loadings proposed by Mr. Cooper and no other of his changes, and it would seem to make it necessary for all plans to be submitted to the chief engineer of the Department of Railways and Canals and to be approved by him. Was that course followed throughout?

Mr. SCHREIBER.—I think so, and as I say I approved nothing until it had gone through Mr. Douglas' hands.

Mr. HOLGATE.—Then the next change appears to be that a new contract was entered into between the Quebec Bridge Company and the government on October 19, 1903. Have you a copy of that contract here?

Mr. SCHREIBER (producing document).—That is the original.

(Document ordered to be entered as Exhibit 64, on the understanding that a copy would be put in by Mr. Schreiber.)

(Mr. Schreiber filed a copy of a letter under date of August 12, 1903, to the Hon. W. S. Fielding (Exhibit 65), acting Minister of the Department of Railways and Canals, recommending the course adopted by the government in the issue of that order in council—Exhibit 18.)

Mr. HOLGATE.—This contract (Exhibit 64) is called the guarantee agreement?

Mr. SCHREIBER.—Yes, sir.

Mr. HOLGATE.—In clause 7 of that document reference is made to the Chief Engineer of the Government Railways?

Mr. SCHREIBER.—Yes.

Mr. HOLGATE.—Who is meant by that officer?

Mr. SCHREIBER.—It is intended to mean me, but that was not my title.

Mr. HOLGATE.—Then, that is just a clerical error, is it, or a lawyer's error? Clause 12 of that agreement calls for the plans and specifications for all the works of the undertaking to be submitted to and approved by the Governor in Council before any work is constructed thereunder?

Mr. SCHREIBER.—I could find no such order this morning in looking through the papers.

Mr. HOLGATE.—Then the work was not carried out in accordance with this clause?

Mr. SCHREIBER.—I cannot tell you. I am only telling you that in the papers placed before me this morning by the department I could find no such order as that.

Prof. KERRY.—Was the question of the jurisdiction of the Board of Railway Commissioners over this structure ever discussed, Mr. Schreiber?

Mr. SCHREIBER.—I never heard it. I think, by virtue of their office, they would have something to say in regard to it.

Prof. KERRY.—My remembrance is that the Board of Railway Commissioners commenced active life about the 1st of February, 1904.

Mr. SCHREIBER.—Yes, I suppose that would be the time they took an active interest in things.

Prof. KERRY.—And the plans for the structure which has fallen would not have reached the department until probably the fall of 1904 or later?

Mr. SCHREIBER.—I am unable to say how that is. I could not find that order this morning among the papers. It may be in the department but overlooked, you know.

Prof. KERRY.—So that although the Railway Act of 1903 required the approval of the plans for all bridges of over 18 feet span, the plans for this structure really never reached the Board of Railway Commissioners?

Mr. SCHREIBER.—I could not say. They may have considered the plan.

Mr. HOLGATE.—In the guarantee agreement, Mr. Schreiber, in clause 13, I see 'the continuation of the work of constructing the said undertaking,' that is the bridge, 'shall be proceeded with as soon as the plans thereof are submitted to and approved by the Governor in Council, and such undertaking shall be completed not later than—' were those plans submitted to and approved by the Governor in Council?

Mr. SCHREIBER.—I think not, as far as I know. As I told you a few minutes ago, I could find nothing amongst the papers that were placed before me by the department this morning. I could find no such order in council there, but the original plan had been approved by the Railway Committee of the Privy Council. The Railway Commissioners superseded the Railway Committee of the Privy Council.

Mr. HOLGATE.—We find that the plans from which the structure was built are signed by the Deputy Minister and Chief Engineer of Railways and Canals?

Mr. SCHREIBER.—Yes.

Mr. HOLGATE.—Under what authority were those plans signed?

Mr. SCHREIBER.—I could not remember the law now in regard to that. I must have had some authority to do it.

Mr. HOLGATE.—Those plans were signed by yourself?

Mr. SCHREIBER.—Yes.

Mr. HOLGATE.—As Chief Engineer?

Mr. SCHREIBER.—Well, are they not signed by me as being attached to a report of mine—something of that kind? That is usually the case.

Prof. KERRY.—We understand further, Mr. Schreiber, that your approval of the plans in every case was reserved until Mr. Douglas had made his examination of those plans?

Mr. SCHREIBER.—I do not think there is any doubt about it.

Prof. KERRY.—And reported them satisfactory?

Mr. SCHREIBER.—I should say there is no doubt about it.

Prof. KERRY.—Then, as far as you know at present, Mr. Schreiber, there is no order in council authorizing you to approve the plans subsequent to the making of the guarantee agreement of October 19, 1903?

Mr. SCHREIBER.—I could find none this morning.

(Mr. Schreiber was requested to file with the Commissioners a copy of the guarantee agreement between His Majesty the King and the Quebec Bridge and Railway Company, under date of October 19, 1903—Department No. 15234.)

Mr. HOLGATE.—Then, you put certain inspectors on the work? You, I understand, had an inspector at Phœnixville? Will you let us have a copy of the instruction under which he was acting?

Mr. SCHREIBER.—Mr. C. J. Tomney was there.

(Mr. Schreiber filed a copy of the instructions issued to Mr. C. J. Tomney under date of August 4, 1904, and signed by the secretary of the Department of Railways and Canals; marked Exhibit No. 66.)

Mr. HOLGATE.—Had Mr. Tomney any other duties besides his written instructions?

Mr. SCHREIBER.—Nothing except in connection with the bridge. He had to give us a statement of every piece—every member of the bridge, where it was, what had been removed, what had been delivered at Quebec, and so forth.

Mr. HOLGATE.—Was his inspection entirely in the nature of checking material in regard to the amounts?

Mr. SCHREIBER.—That is all; checking material for payment—the monthly estimate.

Mr. HOLGATE.—He had nothing to do with inspecting the quality of work or material?

Mr. SCHREIBER.—No.

Mr. HOLGATE.—In regard to the inspection of the work done at the bridge itself, who had you?

Mr. SCHREIBER.—Mr. Cooper was really the man who looked after that. As I said before, the interests of the company and of the government were identical. He was supposed to visit it frequently.

Mr. HOLGATE.—Were Mr. Cooper's personal visits frequent enough to ensure a complete inspection?

Mr. SCHREIBER.—Well, I retired from the position in the department. I do not occupy that position in the Department of Railways and Canals now. I retired from that in 1905, so that there was scarcely anything done at that time in regard to the superstructure. I met him down there on two occasions. That is all I remember.

Mr. HOLGATE.—In other words, the work on the superstructure was practically confined to the period after which you retired from the Department of Railways and Canals?

Mr. SCHREIBER.—Yes, sir.

Mr. HOLGATE.—But during your incumbency of the Railway Department had you inspectors who did visit the work?

Mr. SCHREIBER.—Mr. Douglas was down once or twice and Mr. Johnson also visited the works, but the object of his going was more to examine the estimates shown.

Mr. HOLGATE.—Is that Mr. Johnson's business?

Mr. SCHREIBER.—Mr. Johnson's—yes, upon which we were either guaranteeing or paying a subsidy.

Mr. HOLGATE.—Would his inspection include an examination of the quality of the work or simply the quantity of it?

Mr. SCHREIBER.—Yes, he would examine the quality of it as well as the quantity as far as the substructure is concerned, and as far as anything would have been done in regard to the superstructure.

Mr. HOLGATE.—What did Mr. Douglas do?

Mr. SCHREIBER.—Mr. Douglas went down on several occasions. He was down with me twice—I am not sure—certainly once, and may have been twice, and at that time, I do not think there was anything delivered in the way of material for the superstructure. It was all substructure at that time.

Mr. HOLGATE.—You personally visited the work?

Mr. SCHREIBER.—I went down occasionally.

Mr. HOLGATE.—On several occasions?

Mr. SCHREIBER.—Yes, but only the short land spans were erected before I retired. I am not sure about it, but certainly nothing beyond that.

Mr. HOLGATE.—Is there anything that occurs to you in regard to your explanation?

Mr. SCHREIBER.—No, I do not know of anything further?

Mr. HOLGATE.—Had the Department of Railways and Canals, in so far as you know, anything to say in connection with the appointment of the engineering staff of the Quebec Bridge and Railway Company?

Mr. SCHREIBER.—Nothing as far as I know.

Mr. HOLGATE.—Considering the relations of Mr. Cooper to the Quebec Bridge and Railway Company and your opinion of Mr. Cooper's ability and the relation of the government with the Quebec Bridge and Railway Company, would you consider that Mr. Cooper would have the power or authority to amend the specifications for the work from time to time as he might consider necessary or desirable, and would those amendments be tacitly accepted by all parties concerned?

Mr. SCHREIBER.—No, I think not. They would have to be submitted to me and they would come before our bridge engineer—before the bridge engineer of the Department of Railways and Canals—before they would be accepted.

Mr. HOLGATE.—So that, unless we can find a formal acceptance of the changes or alterations made in the specifications we would have to consider them as unauthorized?

Mr. SCHREIBER.—Certainly.

Mr. HOLGATE.—And yet the structure, no doubt, has been constructed in accordance with the various amendments to the specifications that Mr. Cooper has made from time to time, and payments have been made as the work progressed. How would those payments be made unless the steps leading up to the authorization of those payments were complete?

Mr. SCHREIBER.—The payments, of course, should not be made unless everything was in order, no doubt, but the assumption would be when the certificates left my hands that they were correct, although they might be criticized afterwards or examined afterwards by the Finance Department. But they would be assumed to be correct.

Mr. E. V. JOHNSON, sworn.

Prof. KERRY.—Mr. Johnson, will you state briefly the position you have occupied in connection with the construction of the Quebec bridge and the duties that you have performed?

Mr. JOHNSON.—Well, as inspecting engineer of subsidized railways, I visited Quebec as nearly as practicable once a month for the purpose of making an estimate of the progress of the work of the Quebec Bridge and Railway Company, which included a portion of the railway and the Quebec bridge. This was to ascertain what amount of work had been done during the month and, as I say, to put in a progress estmiate for the release of the bonds.

Prof. KERRY.—Your duty, then, was to visit the work if possible once a month to inspect its progress and to make an estimate for payment of the amounts of subsidy due to the Quebec Bridge and Railway Company up to date?

Mr. JOHNSON.—Yes.

Prof. KERRY.—In those inspections, Mr. Johnson, did you make what we might term a detail engineering examination of the Quebec bridge?

Mr. JOHNSON.—No, my examination was simply to report as to how far the work had gone. I looked at the work generally and reported the condition of the bridge, as far as its extent had gone up to the date of my examination.

Prof. KERRY.—That is, the main object of your inspection was to determine the quantity of work that had been done and only roughly to say that the work was satisfactory.

Mr. JOHNSON.—Yes.

Prof. KERRY.—You did not consider it as part of your duty to study the design of the structure?

Mr. JOHNSON.—Not at all; I considered that as being settled outside of my business.

Prof. KERRY.—Outside of your department? The object of this inquiry, Mr. Johnson, is to determine the cause of the fall of the bridge. Would you, as an engi-

neer, consider that any of your observations have been close enough to enable you to give evidence that will assist the commission?

Mr. JOHNSON.—No, I think not. I simply walked over the bridge, generally up to the end of it, and took a general look over it to see what progress had been made, but I considered that all questions of that sort were settled by others who were in a better position to do it.

Prof. GALBRAITH.—You had to do with making the monthly returns of the actual weights of the pieces in the structure?

Mr. JOHNSON.—Yes.

Prof. GALBRAITH.—Have you any information as to how those weights agreed with the weights figured from the drawings upon which the stresses in the bridge were computed?

Mr. JOHNSON.—No, I have not the information on that subject.

Prof. GALBRAITH.—I believe that in the contract there was an allowance made of 2½ per cent as between the actual weights and the estimated weights. Do you know anything about the actual percentage of difference?

Mr. JOHNSON.—No, that is a matter that I never went into at all.

Mr. HOLGATE.—Who signed the certificates for payment?

Mr. JOHNSON.—The chief engineer.

Mr. HOLGATE.—Who is he?

Mr. JOHNSON.—At present, Mr. Butler, the Chief Engineer of Railways and Canals.

Mr. HOLGATE.—Those are the certificates of payment from the government to the Quebec Bridge Company?

Mr. JOHNSON.—Yes.

Mr. HOLGATE.—Those are the certificates that you had to make?

Mr. JOHNSON.—I made my report out in an estimate of the quantities and value of work done up to date to the chief engineer of the department, and on these he issued his certificate for the release of the bonds.

Mr. HOLGATE.—Then the payments made to the contractors on the bridge site were made by the Quebec Bridge and Railway Company. Had you anything to do with the certificates of their engineer?

Mr. JOHNSON.—No.

Prof. KERRY.—One question about your reports. You saw that certain members of the bridge were in place, you had to arrive at the weight of those members?

Mr. JOHNSON.—I did not arrive at the individual weights of them; I had a report from Mr. Tomney, which was always referred to me, and this gave a list of the members and the total weight of a certain class of work that was either at the shop or on Crown land, at Phœnixville, or delivered at Quebec, and I also got the estimates from Mr. Hoare, giving practically the same thing, which I compared to make sure that my estimate would be correct.

Prof. KERRY.—Did Mr. Tomney in his reports of material shipped, give the weight of each individual member or the total weights?

Mr. JOHNSON.—No, he gave the number, a long list of different members with the weight of the pieces and the total weight of all that lot. It might be a million pounds or more; it was just the bulk.

Prof. GALBRAITH.—Were these weights the weights as furnished by the railway companies, or were they weights determined at Phœnixville in the bridge works?

Mr. JOHNSON.—The weights that Mr. Tomney gave to us right on the spot and he got them from the Phœnix Bridge Company.

Mr. HOLGATE.—Was the check complete and continuous, Mr. Johnson, from the shop to the bridge?

Mr. JOHNSON.—How do you mean, Mr. Chairman; do you mean en route, or by dates?

Mr. HOLGATE.—No, was the check complete from the fabrication of a member to its placing in the bridge; I mean with regard to the payment for that material?

Mr. JOHNSON.—Well, not individually, the individual pieces. There was a return made by Mr. Tomney of raw material delivered from the shops to the Phœnixville works, and to the Crown lands.

Mr. HOLGATE.—Was the check complete enough so that if an error had been made it could have been detected?

Mr. JOHNSON.—I doubt it.

Witness discharged.

The Commission adjourned.

SIXTEENTH DAY.

OTTAWA, September 27, 1907.

The Commission met at 10 a.m.

ROBERT C. DOUGLAS sworn.

Prof. KERRY.—Your official position is?

Mr. DOUGLAS.—At the retirement of Mr. Smith, who was formerly bridge engineer, his work was given to me—in 1893, I think, some time—1893 or 1894, or something about that time. Since that time I have been bridge engineer in addition to my other duties.

Prof. KERRY.—That is bridge engineer of the Department of Railways and Canals?

Mr. DOUGLAS.—Yes.

Prof. KERRY.—And in that capacity you had some work to do in connection with the Quebec bridge?

Mr. DOUGLAS.—Some, yes—with the substructure; nothing with the superstructure except the routine part of the plans and the reports.

Prof. KERRY.—No direct connection with the structure?

Mr. DOUGLAS.—No direct connection with the superstructure in any way.

Prof. KERRY.—In Mr. Schreiber's examination yesterday it developed that practically the first step towards construction was in the preparation of the specification by the Quebec Bridge Company and its approval by the Deputy Minister of the Department of Railways and Canals. You know that specification, do you?

Mr. DOUGLAS.—I know that specification.

Prof. KERRY.—It was handed to you for examination?

Mr. DOUGLAS.—No, sir, it was not, to the best of my recollection. I will describe it if you will allow me.

Prof. KERRY.—If you please.

Mr. DOUGLAS.—As nearly as my recollection serves me, Mr. Hoare came into my office with the manuscript specification or with the specification in the galley form, and wanted me to go over it with him. He said: Mr. Schreiber said, 'Go into Douglas and go over the specification with him.'

Prof. GALBRAITH.—What year would this be?

Mr. DOUGLAS.—It was before the 1st of September, 1898. Mr. Hoare and I went over the specification. Some portions of it were founded upon a specification of mine prepared in 1896; that was the first general specification I had written for the Department of Railways and Canals. Other clauses were incorporated, due to

the larger spans of the bridge than those contemplated in the general specification. There were some things I did not agree with and Mr. Hoare would say: It does not make any difference; this specification is not for the construction of the work; it is merely for calling for tenders. That is the best of my recollection. When the contract is let there will be a new specification compiled of a different kind. That is the best of my recollection, and I do not think you will find in the file of the Quebec bridge any endorsement or any report in regard to that. I went through the specification with Mr. Hoare—that is my recollection—in my office. It was not officially referred to me.

Prof. KERRY.—We have on file here a letter from the then Deputy Minister and Chief Engineer of the Department of Railways and Canals advising the Quebec Bridge Company that the specification was approved; the approval, then, was not given on advice from you?

Mr. DOUGLAS.—No, not to the best of my recollection, except that I went over the original specification with Mr. Hoare.

Prof. KERRY.—But Mr. Hoare did not, as I understand you, modify that specification?

Mr. DOUGLAS.—I did not say that there were any modifications required. I accepted the specification in that way; that it was a specification for tenders and not for construction. That is the way I understood it. It was a specification for calling for tenders.

Prof. GALBRAITH.—You practically accepted it, having made no objection to the specification?

Mr. DOUGLAS.—I made no objection to it as a specification for calling for tenders. That is a totally different thing from a specification for construction.

Prof. KERRY.—The whole procedure was a more or less unofficial discussion between yourself and Mr. Hoare?

Mr. DOUGLAS.—Yes, an informal discussion between myself and Mr. Hoare. That is the best of my recollection; I do not remember making any report upon it. I do not think anything will be found in the papers.

Prof. KERRY.—When did the Quebec bridge matter next come to your notice?

Mr. DOUGLAS.—I was instructed by Mr. Schreiber, I think some time in the spring of 1901, to proceed to the bridge and examine into the work that had been done by the Quebec Bridge Company on the substructure. This work consisted principally of masonry in the quarry, some timber for the caissons and such other preparations for constructing the work. That was my first connection with it.

Prof. KERRY.—Will you follow along historically?

Mr. DOUGLAS.—Periodically I made inspection of the substructure and gave estimates on the substructure. I was directed, on a difficult matter in regard to the landing of the south main pier and the foundations, to proceed to Quebec and examine into the foundations, and I think I met Mr. Cooper. In the meantime, Mr. Schreiber came to Quebec, met Mr. Cooper and the foundations were settled without any reference to me or report upon it for the south main pier.

Prof. KERRY.—During this period you are speaking about, Mr. Douglas, the construction tenders were called for by the Quebec Bridge Company?

Mr. DOUGLAS.—Yes, I presume so. I know nothing about that.

Prof. KERRY.—You did not come in contact with any of this?

Mr. DOUGLAS.—No, I did not come in contact with that except by hearsay, that Mr. Cooper had endorsed the plan of the Phœnix Bridge Company and recommended their tender as the plan, and, I presume, their price, were the best. I had no connection with it because at that time the Quebec Bridge Company and the department were apart in one way. It was merely a subsidized bridge, like a dozen others that had been subsidized by the government.

Prof. KERRY.—All that was necessary for the department was to see that the work was sufficiently satisfactory to justify the payment of the subsidy?

Mr. DOUGLAS.—That the general plans were accepted and that the work was going on satisfactorily. Several bridges were going on in the same way—the Cornwall bridge; I inspected that, the bridge on the Musquodoboit river in Nova Scotia, a large bridge with pneumatic pressure, and the Interprovincial bridge over here where there were large piers and foundations. They were all subsidized bridges, and I considered the Quebec bridge a similar bridge to these others.

Prof. KERRY.—When did you next come in contact with matters concerning the superstructure of the bridge?

Mr. DOUGLAS.—The only contact I had with the superstructure, other than the routine moving around of plans in the office, was that the amendments of Mr. Cooper to the specification of 1898 were submitted to me for report. That is the only official connection, outside of the routine of the office, that I had with the Quebec bridge.

Prof. KERRY.—And that was just one set of amendments that he proposed?

Mr. DOUGLAS.—He proposed one set of amendments.

Prof. KERRY.—This only came up once?

Mr. DOUGLAS.—Well, it came up several times in this way; during the interval I made a general sort of report that was not too technical for any layman or engineer that did not know much about bridges to understand.

Prof. KERRY.—Is that a copy of your report (referring to Exhibit No. 58)?

Mr. DOUGLAS.—I have a copy here. My copy of the report is July 9, 1903.

Prof. KERRY.—That is it.

Mr. DOUGLAS.—This is the report that I made.

'OTTAWA, July 9, 1903.

'DEAR SIR,—I have the honour to submit this report upon the proposed amendments to the contract with the Quebec Bridge Company in regard to the specification of the superstructure approved and attached. The proposed changes apply to clauses 28,——

Prof. KERRY.—At that time you had the original printed specification and Mr. Cooper's proposed amendments as well?

Mr. DOUGLAS.—Yes, at that time we had. 'The proposed changes apply to clauses 28, 29, 30, 31, 32, 33, 34 and 35 of the contract specification. Under these clauses and such others as require amendment the Quebec Bridge Company should be requested to substitute the amendments in agreement with their respective numbers.'

I had no connection with Mr. Cooper; it was the Quebec Bridge Company, or Mr. Hoare, their representative.

'The diagrams of engines proposed for train loadings should be denoted as in present specification.'

That is the specification of 1898.

'No approval should be given to future increased train loadings as mentioned in preface and page 3 of proposed amendments.'

Prof. KERRY.—That is to say that you thought it would not be safe to increase the train loadings?

Mr. DOUGLAS.—Yes, as provided for by Mr. Cooper in his amendments.

Prof. KERRY.—Mr. Cooper makes the remark that the train loadings can be safely increased?

Mr. DOUGLAS.—Yes.

Prof. KERRY.—And your report is that you do not consider it safe to do that?

Mr. DOUGLAS.—No.

'In bridges of great span the dead load is of such large proportion to the combined loads it is customary to adopt greater unit stresses than in bridges of ordinary spans. In some of the bridges of large span with a uniform live load and a concentrated load for the floor system the live load for the trusses has been specified 20 per cent less. I should recommend that no greater unit stresses be permitted than 60 per cent.'

In the original draft I had 'in eye-bars and 55 per cent in built members.' I erased the '55 per cent' in built members, but that represents my opinion. My opinion is that no member should be permitted in the bridge greater than 60 per cent of tension members and 55 per cent of compression members, or built members.

'I should recommend that no greater unit stresses be permitted than 60 per cent of the elastic limit of medium steel as specified in the 'general specifications of steel bridges, 1901,' of this department.

That was the new specification which would have applied to this bridge and which had been endorsed by the department, and I did not think that the hodge-podge amendments of Mr. Cooper should be tacked on to the old specification of 1898—that there should be a defined new specification re-written,—'And that the general conditions of that specification as regards stresses of tension, compression, etc., should be followed if a change of contract is desired.' The original specification was a defined contract with the government. It is not my duty nor my office to deal with legal matters but I considered each clause of this a defined contract, and that when Mr. Cooper's changes were submitted the clause as amended should be clearly defined.

Prof. KERRY.—Let us be clear on that point, Mr. Douglas. At this time you had the original specification attached to the contract before you?

Mr. DOUGLAS.—When I first had to do with the Quebec bridge sub-structure I had forwarded to me by the law clerk, or Mr. Schreiber transmitted the subsidy agreement between Her Majesty the Queen and the Quebec Bridge Company. This contract, as I read it, governed my actions.

Prof. KERRY.—The specifications are attached to the agreement?

Mr. DOUGLAS.—They are not attached to this exactly, but the original specifications of the superstructure and the specifications of the substructure were attached to this.

Prof. KERRY.—These are the specifications of September, 1898?

Mr. DOUGLAS.—I have not a copy of the substructure one here and I do not know what the date of it is, but the superstructure is dated Sept. 1, 1908. I do not know whether the substructure is the same date or not.

Prof. KERRY.—That specification of 1898 was made part of the contract between the government and the Quebec Bridge Company?

Mr. DOUGLAS.—Yes, sir.

Prof. KERRY.—And I think you said that the specification did not meet approval and was not referred to you officially?

Mr. DOUGLAS.—To the best of my recollection except in the matter of running over the specification in my office with Mr. Hoare. That is the best of my recollection.

Prof. KERRY.—But at that time you did not regard it——

Mr. DOUGLAS.—I merely regarded that specification as a tentative specification for the sole purpose of calling for tenders.

Prof. KERRY.—And at the time that the subsidy agreement was entered into by the government the specification was not referred to you at all?

Mr. DOUGLAS.—Not that I remember.

Prof. KERRY.—Then when Mr. Cooper suggested these amendments, your intention in making this report was that the bridge should be built in accordance with the department's specification of 1901?

Mr. DOUGLAS.—Yes.

Prof. KERRY.—With certain modifications?

Mr. DOUGLAS.—With certain modifications. I may say that considering the unit stresses, design and erection of the three important parts of a large bridge of that character, and considering that the American government in several cases appointed four or five engineers to consider and determine unit stresses of unexampled magnitude, I thought that this matter was too important to be left to the judgment of Mr. Cooper.

Prof. KERRY.—There is no mention of that in your letter or in your report. In the report to Mr. Schreiber you do not seem to have suggested that procedure?

Mr. DOUGLAS.—It was subsequent to that. I had conversations with Mr. Schreiber and to the best of my recollection in a conversational manner I mentioned the question of consulting engineers. If the matter had been referred to me my intention was to have consulted engineers personally without bringing them in as consulting engineers, and with that in view I wrote to several engineers in preparation, believing that there would be some action taken on Mr. Cooper's amendment.

Prof. KERRY.—What followed the sending in of this report, Mr. Douglas?

Mr. DOUGLAS.—In so far as I was personally concerned?

Prof. KERRY.—In so far as you know?

Prof. GALBRAITH.—There is one point I am not quite clear on as to the date. Between 1898 and July 9, 1903, you made no report on the specifications?

Mr. DOUGLAS.—No sir, not to my recollection. It will be found on the file if there is.

Prof. KERRY.—As I understand it, Dr. Galbraith, there is no official report of any kind bearing on the superstructure that was made by Mr. Douglas other than the one under date of July 9, 1903. Previous to that he had taken no official action of any kind in regard to the superstructure.

Mr. DOUGLAS.—That is it. After these proposed changes I had correspondence with Mr. Hoare; that is personal corresepondence, because, going around through the department would take so long, through the red tape manner you never get anything, and I had correspondence with the chief engineer of the American Bridge Company—Mr. Wolfel. That is in July, 1903. I requested Mr. Wolfel to send the stress sheet of the Monongahela bridge, which was the largest bridge in the world that had been built on what you might call the American principle or the eye bar principle. Mr. Deans, is that not the largest bridge?

Mr. DEANS.—Yes, that is the largest cantilever bridge.

Mr. DOUGLAS.—Mr. Wolfel referred my letter to Boller & Hodge, who were the engineers, and Mr. Hodge was kind enough to forward me the specification and stress sheets of the anchor arm of the Monongahela bridge. Then I had correspondence with the American Bridge Company in regard to the construction of large eye bars, July 24, 1903. Mr. Wolfel sent me their experience in the construction of what eye bars they could furnish of a large character, which were the largest that had ever been built in the world. I had my doubts about the eye bars; there had been no experiments made in regard to them except this last disaster. There has been quite an experiment made there. That is my only connection with the Quebec bridge as far as engineering or the department are concerned.

Prof. KERRY.—Then you made this report to Mr. Schreiber recommending practically that Mr. Cooper's alterations be not approved?

Mr. DOUGLAS.—Practically, of course. The general report will show that in the engineering specification of 1901 the elastic limit was 33,000 lbs. It was a defined amount; that would make 19,800 lbs. a limiting unit stress in tension members and 55 per cent of the elastic limit in compression members; that would make 18,250 lbs. a limiting stress on compression members less the general column formula. The American formula, which I do not like—the long line formula—was used and I was in favour of using the Gordon & Rankin formula.

Prof. KERRY.—At the time that you wrote this report, Mr. Douglas, you were aware that the original specifications attached to the subsidy contract were rather carelessly drawn up?

Mr. DOUGLAS.—I was aware they were not fit for the work. I wanted just one specification—the specification of the department, or the revised specification which had been drawn up by myself and which I knew was a proper report.

Prof. KERRY.—You did not make at that time any special examination of the Quebec Bridge Co's. specification without reference to Mr. Cooper's amendments at all?

Mr. DOUGLAS.—No, except it was a contract with the government.

Prof. KERRY.—You knew that had been approved and you did not consider it.

Mr. DOUGLAS.—There were about 15 or 16 amendments to the specification and my action was to get defined amendments and have another specification drawn up.

Prof. KERRY.—That would be a new specification completely setting aside the Quebec Bridge Co's. specification?

Mr. DOUGLAS.—I have this personal letter from Mr. Hoare and I will merely read portions of it.

'I have your letter of the 12th inst. I am sending you by express the original strain sheets based on specification September 1st, 1898, which you have on file.'

These were personal to my office. He sent them personally.

'The strain diagrams for present design cannot be made until the proposed changes by Cooper are adopted. The figures for the original will give the proportions for all loads; the dead load results will, however, be greater in the present bridge. Don't change the original specification. We desire Cooper's made a supplement to it for loads and unit strains. It can be attached and endorsed as such. A more simple and quicker method of dealing with it than disturbing the original. Please don't change, Cooper's column formula being more practical and rational than Gordon's in any specification.'

Prof. KERRY.—You better refer to the date of that letter.

Mr. DOUGLAS.—June 15, 1903.

Mr. HOLGATE.—From?

Mr. DOUGLAS.—Mr. Hoare.

Mr. HOLGATE.—To?

Mr. DOUGLAS.—To myself. It is merely a personal letter. They wanted the change to go in holus bolus and I could not do anything.

Prof. KERRY.—Subsequent to this report the question of the specification never came before you officially at all?

Mr. DOUGLAS.—Mr. Cooper came to Ottawa and Mr. Schreiber and Mr. Cooper settled on the changes in the specification themselves without any consultation with me.

Prof. KERRY.—Following that action detailed plans for the construction of the bridge were prepared and were sent in to the department for examination and approval?

Mr. DOUGLAS.—Yes, sir.

Prof. KERRY.—You made an examination of these plans for the department, Mr. Douglas?

Mr. DOUGLAS.—Yes, sir.

Prof. KERRY.—And in making that examination were you guided by the original specification, or by the original specification with Mr. Cooper's amendments attached?

Mr. DOUGLAS.—I was not guided by anything except Mr. Cooper's signature; practically, he was responsible for the plans.

Prof. KERRY.—But you checked the plans, did you not, to see that they were in accordance with——

Mr. DOUGLAS.—I checked them in accordance with the contract, I did not compute them.

Prof. KERRY.—But when you were checking your plans did you read Mr. Cooper's

Mr. DOUGLAS.—Oh yes, I considered Mr. Cooper's amendments, certainly.

Prof. KERRY.—As being part of the contract?

Mr. DOUGLAS.—Oh, yes, certainly, his unit stresses and his changed loading were considered in the examination of the plans.

Prof. KERRY.—Had you any official authority for doing that?

Mr. DOUGLAS.—No official authority except the official authority 'referred to Mr. Douglas' written on the sheet.

Prof. KERRY.—No, I mean official authority for considering that Mr. Cooper's amendments were part of the contract.

Mr. DOUGLAS.—No, not that I remember, except by looking through the file; no, I was not notified except by looking through the file. I found that they had probably been approved by order in council.

Prof. KERRY.—I will read over this order in council or part of it, this extract from Exhibit 18:

'The minister further represents that the chief engineer has this day reported, stating that, as the result of the personal interview had with the company's engineer, he would advise that, provided the efficiency of the structure be fully maintained up to that defined in the original specifications attached to the company's contract, the new loadings proposed by their consulting engineer be accepted; all detail parts of the structure to be, however, as efficient for their particular function as the main members for theirs, the efficiency of all such details to be determined by the principles governing the best modern practice, and by the experience gained through actual test; all plans to be submitted to the chief engineer, and until his approval has been given, not to be adopted for the work.'

Prof. KERRY.—Is that the order in council that you refer to?

Mr. DOUGLAS.—I do not remember ever reading it.

Prof. GALBRAITH.—What is the date of that?

Prof. KERRY.—August 15, 1903.

Mr. DOUGLAS.—My recollection is that I read Mr. Schreiber's report to the minister recommending the approval of these amendments themselves, and then written on 'O. in C.,' something like that, order in council, and that is all I know about it.

Prof. KERRY.—This is word for word the same as Mr. Schreiber's letter?

Mr. DOUGLAS.—I remember reading Mr. Schreiber's report but I do not remember the following up of the official action.

Prof. KERRY.—You might look over this (Exhibit No. 60), Mr. Douglas, and see if this is a copy of the letter from Mr. Schreiber that you read?

Mr. DOUGLAS.—No, sir, I do not think it was; it was a letter referring to Mr. Cooper as a celebrated engineer and all sorts of things.

Prof. KERRY.—We do not seem to have that letter of Mr. Schreiber's but Exhibit No. 17 contains a copy of it. Perhaps that is the letter you refer to, Mr. Douglas?

Mr. DOUGLAS.—Yes, sir, that is the copy I read, it is followed up by an order in council, so I did not bother with the order in council.

(Mr. Douglas identified the letter, a copy of which forms part of Exhibit No. 17, as the letter he saw.)

Prof. KERRY.—You concluded then, without any precise instructions, that Mr. Cooper's amendments were approved of by the department?

Mr. DOUGLAS.—No, I would assume from the letters there would be an order in council, that is an order in council approving, but as to the special reading of the order in council, I do not remember. I would see on the backing that an order in council naturally had been passed approving of the amendments.

Prof. KERRY.—The amendments had already been referred to you at that time, and you had a copy of them in your possession?

Mr. DOUGLAS.—No, sir, I had not a copy in my possession, they were in the file.

Prof. KERRY.—You returned them to the file?

Mr. DOUGLAS.—Yes, they were in the file. I did not have anything to do with them.

Prof. KERRY.—They were there, I suppose, where you could consult them at any time?

Mr. DOUGLAS.—Oh, yes.

Prof. KERRY.—In the order in council pursuant to that letter of Mr. Schreiber's, they say 'that the new loadings proposed by their consulting engineer be accepted,' and as we read that, that simply approved the increase of live loads.

Mr. DOUGLAS.—No, the amendments, there was a change of live loads. To the best of my recollection there was a change of live load on account of the increased span; it was 200 feet longer. The original live loads were for a 1,600 foot span, and changing to 1,800 feet necessitated a new condition of what is called loadings. This is a diagram I found showing Mr. Cooper's amendments as to loadings, which were quite correct.

Prof. KERRY.—What diagram is this?

Mr. DOUGLAS.—This is a copy I made to show you what it means.

Prof. KERRY.—The point I am trying to clear up is this, that the order in council seems clearly to approve the change of the live loadings; it does not seem to approve any increase in the unit stresses.

Mr. DOUGLAS.—I do not know anything about that.

Prof. KERRY.—But in a subsequent examination of the plans made by the department the increase of the unit stresses was adopted.

Mr. DOUGLAS.—Yes, the increase.

Prof. KERRY.—You used in your examination——?

Mr. DOUGLAS.—I used in my examination Mr. Cooper's amendments as those amendments were noted by the Phœnix Bridge Company on their plans. These plans bore a note, as I remember, 'according to the specifications of the Quebec Bridge Company as amended by Theodore Cooper.'

Prof. KERRY.—That was used?

Mr. DOUGLAS.—That was used in the examination of the plans.

Prof. KERRY.—For checking the plans?

Mr. DOUGLAS.—In checking them, examining them.

Prof. GALBRAITH.—Did you understand that the change in live loading was due to a change of span from 1,600 to 1,800 feet? That was your understanding, was it?

Mr. DOUGLAS.—Oh, that was my understanding essentially, yes. And it was necessary; whether that loading was advisable or was correct is a matter of opinion.

Prof. GALBRAITH.—And you approved that?

Mr. DOUGLAS.—Yes, the change of 200 feet in the length of the span necessitated a change of live load.

Prof. GALBRAITH.—That was the consideration that came in there, that was the cause?

Mr. DOUGLAS.—That was one of the causes.

Prof. KERRY.—There is a copy (Exhibit 21) of the Quebec Bridge Company's specification, of September 1, 1898, with Mr. Cooper's amendments attached to it, the amendments being dated June 2, 1903. Can you identify those papers as being copies of the specifications that were used by you in checking the plans submitted by the Quebec Bridge Company?

Mr. DOUGLAS.—I can identify the specification of 1893, but Mr. Cooper's amendments that were referred to me would be marked 'referred to Mr Douglas.' This is a copy, I presume; these are the ones certainly.

Prof. KERRY.—You might just look at them and make sure that they are.

Mr. DOUGLAS.—This appears to be the same, some of it appears to be the same but my impresion is that Mr. Cooper's amendments were in manuscript, Mr. Cooper's handwriting, what I saw or what I took note of. I took note of them, I think they are similar. If I remember rightly they were in manuscript; I do not know.

Prof. KERRY.—In your examination of the plans submitted did you use the notes that you referred to or did you use the notes found on the Phœnix Bridge Company's plans?

Mr. DOUGLAS.—I used principally the notation of the Phœnix Bridge Company's plan together with the notes I had taken of Mr. Cooper's amendments.

Prof. KERRY.—Could you say that these amendments attached to this exhibit (Exhibit 21) agree with your notes?

Mr. DOUGLAS.—I think so, practically, yes; yes, as far as that is concerned. I have the notes here.

Prof. KERRY.—We understand that these facts in this document are entirely your personal opinions and are in no way official?

Mr. DOUGLAS.—Those are merely a collection of facts for an enlarged report, a general report, an engineering report.

Prof. KERRY.—If you see fit to do so, Mr. Douglas, the Commission would be very pleased to have a copy of your own professional opinions of that date.

Mr. DOUGLAS.—That is not an opinion, that is simply a collection of facts.

Prof. KERRY.—We would be very pleased to have it?

Mr. DOUGLAS.—Very well, if you take it as it is.

(At the request of the Commission, Mr. Douglas filed some notes made by him personally during the summer of 1903 with regard to large span bridges. Document filed and ordered to be copied and marked as Exhibit No. 67.)

Mr. HOLGATE.—This was never made official use of in your department?

Mr. DOUGLAS.—No, I never made a report, the thing was settled.

Prof. KERRY.—Now, the procedure, as I understand it, was for the Quebec Bridge Company to send its plans up to the department for approval, and they would be sent to your office by the department.

Mr. DOUGLAS.—For examination; correct, sir.

Prof. KERRY.—And after you had examined them and signed them——

Mr. DOUGLAS.—Signed as examined they would go to the chief engineer for approval.

Prof. KERRY.—Will you let us know just how completely those plans were examined; what part of the plans?

Mr. DOUGLAS.—The plans were examined first for Mr. Cooper's signature, that is the principal part of it. Then they were examined to see whether they were in accordance with the specifications as attached to the contract with the Quebec Bridge Company.

Prof. KERRY.—Was the stress sheet checked over in that examination, Mr. Douglas?

Mr. DOUGLAS.—No, the stress sheet did not come in until after the plans. The plans came in before the stress sheet. There is no checking, there were no computors in the office and there is no information in the office, even if there were, to check up.

Prof. KERRY.—And some plans, Mr. Douglas, were probably officially approved by the department before the stress sheet was received?

Mr. DOUGLAS.—The first note of the plans coming in to me, the first plans came in October 3, 1903, enclosed as 'blue prints—details of floor beams and stringers "all approved by Mr. Cooper".' Mr. Hoare sends these in all approved by Mr. Cooper. Then on November 4th, the floor system of anchor arm; then for January 21st, 1904, truss floor beams of cantilever arm; on January 19, 1904, truss floor beams; on March 8th, 1904, truss floor beams, anchor arm. Then on April 8th, design of suspended span. June 18th, stress sheet anchor arm. I suppose that some of the floor beams were built before the plans were approved, for all I know.

Prof. KERRY.—June 18th, 1904, that would be the time the first stress sheet reached you?

Mr. DOUGLAS.—It came into the department, yes. That is the date I have put. The first plans came into the department on October 3, 1903. That is, the plans of the large bridge, I did not mean the approach spans. I have noted the stress sheet of the anchor arms, June 18th, 1904.

Prof. KERRY.—Then with regard to these stress sheets, Mr. Douglas, under the

system of examination, the actual stress on each member would not be checked at all in the department?

Mr. DOUGLAS.—They would not be checked in the department; they would not be checked by me, for in that way I would be holding myself responsible for all the bridges over the country.

Prof. KERRY.—You have no staff to do that?

Mr. DOUGLAS.—No, I have no staff to do that. Generally with subsidized bridges they place a contract before the department and they agree to do certain things and certain loadings and certain stresses and all that sort of thing. If they make a mistake in their plans it is their own funeral.

Prof. KERRY.—If a mistake is made in those plans the department has no machinery——

Mr. DOUGLAS.—No, only that in observing the plans if I saw anything wrong with them in the general examination—I do not simply look at them—if I should see anything wrong of course I draw attention to it.

Prof. KERRY.—Then would you proceed to determine that each member had sufficient sectional area to carry the strain shown on the stress sheet?

Mr. DOUGLAS.—No, not exactly that. I would take the stress denoted on the stress sheet and divide it up by Cooper's amendment—by the unit stress as denoted on the plan.

Prof. KERRY.—And see whether the area was——

Mr. DOUGLAS.—Whether they corresponded—not exactly as checking.

Prof. KERRY.—In each case what would you do?—take the total stress shown, divide it by the effective area of the member and see whether the unit strain was less or more?

Mr. DOUGLAS.—Was the same as endorsed on Mr. Cooper's amendments.

Prof. KERRY.—In each case, before you put your signature to the plan, you found that the plan was correct?

Mr. DOUGLAS.—Yes, the plans were correct in every way as far as my general observation as an engineer indicated. They were well drawn and the details were good. There was nothing wrong with them in any way.

Mr. HOLGATE.—As far as you know, they were complete?

Mr. DOUGLAS.—Yes.

Prof. KERRY.—You examined them from what you might call an engineer's point of view, not a computing office point of view?

Mr. DOUGLAS.—Yes.

Prof. KERRY.—You examined the detail of each of the members?

Mr. DOUGLAS.—Yes, I examined them as an engineer so as to be conversant with them if anything occurred.

Prof. GALBRAITH.—You made yourself familiar with them, and with all the connections?

Mr. DOUGLAS.—That was after the examination I made myself familiar with them. I did not go into all tie plates, splice plates and rivets and everything of that description. I looked at them as an engineer as a question of interest.

Prof. KERRY.—You know there is now considerable suspicion in regard to the efficiency of some of the lower chord members?

Mr. DOUGLAS.—Yes.

Prof KERRY.—You examined these plans from an engineering point of view and found them satisfactory?

Mr. DOUGLAS.—I thought them satisfactory as far as the specification went. If they had been built according to the calculation of 1901 they would have had to have had a cover plate upon them.

Prof. KERRY—At the time that you looked over the plan you were not at all apprehensive as to the safety of the structure?

Mr. DOUGLAS.—No, not in the slightest, except that after the fact, or before the fact, there might be some criticism.

Mr. HOLGATE.—But you made no criticism?

Mr. DOUGLAS.—I was not asked; I made an examination, that was all.

Mr. HOLGATE.—In your examination of the various specifications, Mr. Douglas, and any recommendations which you made, did you make any recommendations with regard to the fabrication of the bridge or in regard to its erection?

Mr. DOUGLAS.—My connection with the Quebec Bridge Company ceased at that report as an engineer.

Prof. KERRY.—Would it be a fair statement, Mr. Douglas, to say that for all practical purposes in connection with the actual design and construction of the bridge, Mr. Cooper could be considered as acting as engineer in charge for the department?

Mr. DOUGLAS.—I should not say that he would be exactly—not as I understood it or understand it.

Prof. KERRY.—I want to get at it, not formally, but as a matter of absolute fact. Any detail of construction that would be approved by Mr. Cooper, or any engineering question that would come up, and on which Mr. Cooper would pronounce a definite opinion would be settled in accordance with Mr. Cooper's opinion?

Mr. DOUGLAS.—I should say that is my understanding of Mr. Cooper's connection —I would not say with the government—but with the Quebec Bridge Company, because you could not get anything from the Quebec Bridge Company except from Mr. Cooper.

Prof. KERRY.—And the department practically accepted any plans that carried Mr. Cooper's signature?

Mr. DOUGLAS.—I do not know about the department. They were sent to me for examination; I examined them and then Mr. Schreiber approved them. He is the department. He takes the responsibility of approving them.

Prof. KERRY.—Mr. Schreiber told us yesterday in his evidence that it was generally understood that the interests of the government and the Quebec Bridge Company were alike, and that those interests were considered to be thoroughly taken care of by being entrusted to Mr. Cooper.

Mr. DOUGLAS.—That condition has arisen since I had anything to do with the bridge as an engineer—that is since the specification—so that I know nothing about it.

Prof. KERRY.—As far as you know, that was what you might call the general temper of the department?

Mr. DOUGLAS.—As far as I know. Everything went.

Mr. HOLGATE.—You said that in examining the plan the thing you looked for was Mr. Cooper's signature?

Mr. DOUGLAS.—Certainly. He was paid for that business, and I saw that he had his name there. I presume the department considered that Mr. Cooper was the authority, because they never referred anything to me.

Prof. KERRY.—As far as you know, Mr. Douglas, there was never any proposal on the part of the government to appoint an engineer who should be permanently resident in the vicinity of the bridge during construction?

Mr. DOUGLAS.—I do not know of any such movement. Previously on bridges on which I was acting as bridge engineer, I had my own personal inspector, and he reported to me week by week or day by day. That was the customary method. When the Cornwall bridge collapsed there was a great hubbub in the papers about the inspection of bridges, and most of the large bridges I had an inspector on.

Prof. KERRY.—In this case the usual practice of the department was not followed?

Mr. DOUGLAS.—No, I cannot say that. There was no practice about it. Sometimes on an important structure they would instruct me to look after it, but if the department were going to look after the construction of bridges all over the country they would have a pretty big contract.

Mr. HOLGATE.—In the case of the Cornwall bridge, was there a consulting engineer employed on that in the same capacity as Mr. Cooper?

Mr. DOUGLAS.—No. It was more with regard to the substructure, the pressure work and the re-enforcement of the piers and that sort of thing that I was down there.

The building of the superstructure of the Cornwall bridge was in American territory, and we had nothing to do with it.

Prof. KERRY.—We understood you to say that you had not had occasion officially to visit the bridge during the progress of the superstructure at all.

Mr. DOUGLAS.—In that connection I would correct a misapprehension of Mr. Schreiber in his evidence yesterday. He, by interjecting my name in many places, would lead you to think that I had been connected with the bridge during the whole construction. I only visited the bridge during the time of the construction of the substructure. Since the commencement of the erection of the superstructure I have not visited the bridge, and I never saw it until it collapsed.

Prof KERRY.—And to the best of your knowledge, Mr. Douglas, no other officer of the department visited the bridge for the purpose of carefully inspecting the details of construction.

Mr. DOUGLAS.—I thought that perhaps Mr. Johnson was doing the work in the way it should be done. An engineer could not do it. He could not climb over the bridge; he would have to have his own inspector—a man he had confidence in. An engineer would not do any good; he would want a first-class inspector. At least I would not climb 350 feet high, or 150 feet from the ground.

Mr. HOLGATE.—Then, was the regular procedure of your department applied to the construction of the Quebec bridge?

Mr. DOUGLAS.—There was no regular procedure.

Mr. HOLGATE.—I understand that there is a regular procedure in your department in regard to the construction of subsidy bridges?

Mr. DOUGLAS.—Not in regard to inspection.

Mr. HOLGATE.—In regard to the connection of your department with subsidy bridges?

Mr. DOUGLAS.—Yes, ordinarily.

Mr. HOLGATE.—Was that regular procedure followed?

Mr. DOUGLAS.—Yes, as ordinarily.

Mr. HOLGATE.—Was there anything more than the ordinary procedure followed except that you had the assurance of the Quebec Bridge Company of their appointment of Theodore Cooper as their consulting engineer?

Mr. DOUGLAS.—That is as I understood it. I always considered that it was the regular procedure of the department in regard to a subsidized bridge. After the government came into it, I do not know anything about it.

Mr. HOLGATE.—I think that is all, unless there is anything you wish to say.

Mr. DOUGLAS.—No, I have said all I wish to say.

The Commission adjourned to meet again at the call of the Chairman.

The Royal Commission on the Quebec Bridge met in New York city, October 14, 1907, and proceeded with the examination of Mr. Theodore Cooper, consulting engineer of the Quebec Bridge Company, which lasted until October 22.

MR. COOPER'S TESTIMONY.

Q. What were your first relations with the Quebec Bridge Company or with any of its officials and at what date?—A. About February 25, 1899, I received a communication from the Quebec Bridge Company asking if I was at liberty to take up the examination of their competitive plans. I replied in the affirmative. The next occurrence, as far as my memory goes, was upon the 23rd of March, when Mr. Parent, Mr. Hoare and Mr. Barthe, the secretary, came to New York and had a personal interview with me. They gave me a brief account of what the plans were, I having had

no previous knowledge of the same, and asked me upon what terms I would undertake the examination, and how much time it would probably require. I stated, with the slight knowledge I had of what they were describing, and assuming that they wished a relative report rather than a detailed critical report on all the numerous plans, that I thought it would require about three months' time, and I stated my fee for performing that service. They then asked me under what terms I would act as consulting engineer when the work was under construction. I stated my fee. They then asked if the inspection of the work was included in my services. I distinctly stated it was not. They then asked me to give them an estimate of what the probable cost of the inspection would be. I told them that with the slight knowledge I had of the subject my estimate would be very much in the line of a guess, but I assumed from the magnitude of the work and from what I supposed it would be that it would probably cost from $20,000 to $25,000 for the shop inspection. I do not think they accepted any of my offers at that time, but Mr. Parent left me under the impression that the plans would be sent to me. My offer as consulting engineer was not acted upon.

Q. Previous to your engagement to report upon the competitive plans had you been consulted in any way about the project and had you seen the plans and specifications prepared by the Quebec Bridge Company?—A. No, I had no knowledge in regard to the project except what was in the technical papers stating what they proposed. I had no definite knowledge except the general knowledge that they were preparing to build a bridge at Quebec.

Q. Were the outlines of the preliminary plan prepared by the Quebec Bridge Company generally followed in the final design?—A. That question I do not thoroughly understand, but I suppose it has reference to the legal requirements which, I think, were embodied in the tracing showing the profile of the river, the distances and the legal requirement of 1,200 feet at a certain elevation above the water. That is the only preliminary plan that I know of.

Q. By whom were the details and outlines of this preliminary plan suggested?—A. I do not know.

Q. Did you consider that any change in the general type or outline of the structure was desirable and were any studies made to this end?—A. Certainly not at that time, because I had no knowledge of any type or other outline than before mentioned.

Q. At the present date and with the advantage of the several years of additional experience would you confirm your original recommendation both as to the type of the structure and as to the merits of the design submitted?—A. Yes, if under the same limitations that existed at that time as to the amount of funds apparently estimated for the construction. That is an important point, because the structure was apparently limited to the amount of funds they had in sight as far as it was impressed on me. The impression was given me that this work was to be constructed by a private corporation, that the amount of money that they expected to have was a limited amount, and the question to be decided was the possibility of building the best bridge within the financial strength of the company. The question of the best bridge was not brought up at all. So that, to answer that question a little more fully, it must be limited by that statement, but with my present knowledge I could make further recommendations.

Q. It is not an unknown practice for a bridge-building company to secure the promise of a contract from the promoters at a very early date, and in advance of the calling for competitive tenders?—A. It is a general belief that that is not an unknown practice.

Q. Have you any reason to think that any such understanding existed between the officials of the Quebec Bridge Company and the Phœnix Bridge Company previous to the final award of the contract?—A. Not to my knowledge. I was left absolutely unhampered in any manner in my report as to which I should consider the best plan and the best bridge. In no manner was there anything indicated to me that one plan should be preferred over any other or any one bid over any other.

Q. On what date did you accept appointment as consulting engineer to the Quebec Bridge Company?—A. I received a letter appointing me consulting engineer to the Quebec Bridge Company on May 6, 1900.

Q. What extent of professional responsibility was given to you in connection with this work by the Department of Railways and Canals, and how and when was this responsibility given?—A. In a supplementary report with even date of my report upon competitive plans, June 23, 1899, I stated in a general way that my examination of the competitive plans was based entirely upon the specification and data furnished me by the Quebec Bridge Company, that I thought, before the construction of the work should be undertaken, careful study should be made to see if a better bridge could not be had and whether a change of span was not desirable. On May 10, 1903, Mr. Parent informed me verbally—I think it was—that the financial affairs were in such shape that the work could now be done. I then took up again with the Phœnix Bridge Company and with the chief engineer the necessary modification of the loads and stresses to suit a bridge of this magnitude. After considerable discussion between Mr. Szlapka, the designing engineer of the Phœnix Bridge Company, myself and Mr. Hoare, it was found that nothing could be done in the way of changing the original specification except with the authority of the Deputy Minister of the Department of Railways and Canals. After considerable correspondence (which is on file) and discussion and a personal visit by myself to Ottawa, I received, on August 23, a copy of an order in council dated August 15 (Exhibit No. 18), certified by the Clerk of the Privy Council, giving me, in a general statement, the authority to make modifications from time to time in the specifications and the proposed loadings, subject to certain provisos, and 'provided the efficiency of the structure be fully maintained up to that originally defined in the original specifications attached to the company's contract' (Exhibit No. 12).

Q. Did you at any date ask to be relieved of your duties, and for what reasons? If you made such a request, at whose instance was it withdrawn?—A. I cannot give dates, but fully three years ago, I think—certainly over two years ago, before the work of erection had commenced at Quebec—Mr. Parent, in my office, asked me when I was going to Quebec next. I answered: 'Mr. Parent, I never expect to be able to go to Quebec again; I am under the ban of my physician, and I feel that I ought to be relieved of the responsibility which is upon me, as it is impossible for me to give it that attention that I conscientiously feel I should do.' I do not, of course, know whether Mr. Parent looked upon that as an official statement, but he protested, and said: 'Mr. Cooper, we never intend to let you go until the bridge is done; we have confidence in you and we want your services continued.' About the same time I told Mr. Deans, the chief engineer of the Phœnix Bridge Company, that I thought I should withdraw, that while I appreciated the complication that it would involve and the difficulty of their mutually selecting somebody who would be satisfactory, I would gladly withdraw from any further responsibility. He likewise protested, and said they could not submit to that; that they did not know of any one upon whom they could all mutually agree, that they felt the same confidence in and to whom they would be willing to submit an important contract like the one under execution. Realizing this difficulty, and feeling also a pride and a desire to see this great work carried through successfully, I took no further action.

Q. Was your advice asked in connection with the framing of the contract for the construction of the bridge, and if so, upon what points?—A. I do not recollect in any manner having been consulted on the framing of the contract.

Q. Are you conversant with this contract?—A. I have no knowledge whatsoever in regard to this contract except what I have gathered casually and inferentially from time to time.

Q. Did you consider that the order in council of August 15, 1903 (Exhibit No. 18), gave you as consulting engineer for the Quebec Bridge Company full and absolute authority to amend the specifications and to order such alterations in the construction

plans as seemed best in your judgment?—A. Yes, under the restriction that the efficiency of the structure should not be in any way reduced from that originally proposed, and subject to the provisos previously referred to.

Q. Had your decisions to be referred for confirmation to any officials of the Quebec Bridge Company, or of the Dominion of Canada?—A. I think every change of any importance, certainly all those in the specifications, were referred to the chief engineer, Mr. Hoare, and supposedly through him to the department.

Q. Please state what alterations were made on your advice and on your authority to the original specifications attached to the contract? Were these alterations accepted by the Phœnix Bridge Company without discussion, and were they observed by it throughout the work?—A. As an experienced engineer of many years' standing, I recognized that the original specification of the Quebec Bridge Company was what I would call a 'scissored' one; that it was not drawn upon any theory by any person having the importance of this bridge structure in his mind. Although a specification for a Canadian bridge, there was no recognition of the snow weight that must at times come upon this structure. The requirements for the wind strain were those practically imposed upon the Forth Bridge against the protest of the chief engineers of that bridge, Messrs. Baker and Fowler. The train load and train requirements were not as great as I thought they should be in the present state of transportation. I saw that a large amount of the material in this bridge was going to be devoted to giving it horizontal strength against an imaginary and an impossible wind, material that could be much more favourably placed to give the bridge vertical strength under higher train loading. I therefore corrected the specifications to provide for a less wind strain than that originally required, with a greater vertical loading than that at first required. Being impressed with the necessity of restraining the weight of the structure under these new loadings and changes of loads so that it would not exceed the original estimated weight contained in the contract, I made modifications in the unit strains to be employed upon the various members, with the view of keeping the final weight within the limitations and yet obtain more harmony in the relative strength of the different parts of the structure. Previous to taking up the consideration of the new loadings, the 210 feet spans making the approaches on each side had been constructed. On examining the plans, when submitted to me, I found that the floor system was excessively heavy. I immediately wrote to Mr. Hoare, the chief engineer of the Quebec Bridge Company, that I found the floor system on these 210 feet spans unnecessarily heavy, that they exceeded by 18 to 20 per cent the best requirements of the Pennsylvania Railroad and all first class railroads in the United States; that I understood that directions had been given to build these approach spans according to the official specifications of the Department of Railways and Canals of Canada. I wrote to Mr. Hoare as follows: 'While it is a matter of not much importance for these particular spans, if this is to be taken as a precedent for the main spans, it will add considerably to the weight.' I afterwards explained that for every extra pound put in the floor system from four to five pounds extra metal would be required in the trusses to carry it, and that this excessive requirement would render it impossible to build the structure within the limitation of the financial ability of the company, and that I did not consider it would in any way detract from the perfectly safe and satisfactory building of the bridge to lower the requirements to those accepted by the first class railroads throughout the United States.

Q. Were these alterations accepted by the Phœnix Bridge Company without discussion, and were they observed by it throughout the work?—A. As I believe I stated previously, these alterations made by me were discussed with the designing engineer of the Phœnix Bridge Company. This, however, was not for the purpose of getting at their wishes, but to get the benefit of the views of Mr. Szlapka, a brother bridge engineer, upon the suggestions that I was making.

Q. Please state the approximate dates upon which the following operations were commenced:—

(*a*) The preparations of the final plans in detail.

(*b*) The rolling of the necessary metal.

(*c*) The fabrication of the metal in the shops.

(*d*) The erection of the structure into position at the site.

A. Most of these questions will have to be answered by the contractor if exact dates are required. As to the preparation of the final plans in detail, I could give you the dates from the different plans if I had my office plans here, but speaking from memory I cannot. On September 15, 1903, I received the first plans, the plans for the floor system.

The rolling of the necessary metal undoubtedly commenced as soon as they got my approval of the first plans. Of course that is a presumption; the exact information can be obtained from the Bridge Company itself. While I know they started rolling the metal as soon as they could, my testimony would not be positive on that matter; I simply answer, about the latter part of September.

The information as to the fabrication of the metal in the shops would be obtained in the same way; they all followed one after the other. I do not suppose it would be three weeks after I received the plans until the shops were going on the floor system.

The erection of the bridge began on the south anchor arm on July 22, 1905.

Q. Was there ample time between the award of the contract and the beginning of the work in the mills and shops for the preparation of the construction drawings? Do you consider that sufficient time was given to the study and preparation of the drawings, and, if not, for what reasons was this time curtailed?—A. The Phœnix Bridge Company practically had the contract for the construction of this bridge several years before they commenced the preparation of the plans. I urged them at an early date to prepare their studies and plans as far as possible for the accepted 1,800 foot spans for which no plans had yet been prepared, stating that in an important work like this very cautious and very careful consideration would be required in each and every individual detail of the structure, and that this should be done before the rush of construction would come upon us. They gave this no attention, and practically made no steps towards preparing the plans until they had completed their financial arrangements and had executed their present contract as I believe dated June 19, 1903 (Exhibit No. 16). There has not been time enough given, in my opinion, to the careful study and preparation of the drawings and plans of this structure, free from the rush and push of its practical execution. As I understand it, the time stated in this contract for the completion of the work, as verbally given me by Mr. Deans at the time, is three years. I protested against that, and stated it was an absolute impossibility to construct that bridge in three years, that under the most favourable circumstances without considering any contingencies, four years at least would be needed, and in my judgment five at least should have been asked for. I told Mr. Deans at that time that this meant rush and hurry, and the impossibility of giving thoughtful and careful consideration to every step before undertaking the work in the shop. The urgency and demand of the manufacturing side of this problem have, in my opinion, outweighed and burdened the technical and thoughtful consideration of all the plans.

Q. What organization existed for the checking of the strain sheets and detail plans prepared by the Phœnix Bridge Company?—A. My own office organization absolutely.

Q. At whose expense was this organization maintained and was it sufficient for the purpose?—A. At my own expense, and it was not sufficient for the purpose considering the other duties which were imposed upon me improperly.

Q. Was this work properly part of the duties of the consulting engineer?—A. I so considered it to be.

Q. Was it found necessary to order alterations in the plans prepared by the Phœnix Bridge Company in any important particulars and, if so, what were the principal alterations made?—A. Yes, numerous and comparatively minor alterations were frequently called for when the detail plans did not fully come up to the require-

ments. The most important alteration, however, was that of the long eye-bar chord of the anchor arm. It was about the first of June, 1904, that the Phœnix Bridge Company submitted their plan and arrangements for the top chord and diagonals of the anchor arm. After careful personal examination, I declined to approve it as having violated the requirements that I had stated in a personal conference with the engineers and proprietors of the Phœnix Bridge Company I should demand. At that conference I stated that I would accept no bars exceeding two inches in thickness unless it was an absolute necessity to use a greater thickness. My experience had proved to my mind that when that thickness was exceeded satisfactory bars could not be obtained. In this plan submitted for the top chord they had used bars two and one-half inches in thickness and other prohibitory thicknesses, and they had arranged the bars at angles which were, to my mind, thoroughly unsatisfactory and I called for a new design. Mr. Szlapka came and had a personal interview and protested that it could not be made better, that he had had his best men on it for two months and he could see no change that could be made in it that would come nearer to my requirements than this plan. I stated I never would approve it and finally I was compelled personally, although it was work I had not done for twenty years, to redesign the whole system. It was a very arduous and trying work and when I was through I was thoroughly exhausted. I gave them a copy of my design and stated that it was not the best that could be done, but that it was the best that I could do, and I hoped now they would take the matter up from the point of view of the changes I had made and still further improve it in certain details which I pointed out. It was in early June that I first took up the question of this eye-bar chord. While I was working on this chord, on July 10, Mr. Szlapka brought me a new packing which I refused again to approve and it was not until July 31 that I succeeded in getting from the Phœnix Bridge Company a satisfactory chord packing in conformity with my views and requirements.

Q. Were the plans finally approved to your entire satisfaction or would you have given them further study had you been able to do so?—A. I should have been glad to have had the physical strength and the time allowed me to have given further study to many parts of this structure, but in my physical condition I have been compelled, and must accept the responsibility for the same, to rely, to some extent, upon others. I had and have implicit confidence in the honesty and ability of Mr. Szlapka, the designing engineer of the Phœnix Bridge Company, and when I was unable to give matters the careful study that it was my duty to give them, I accepted the work to some extent upon my faith in Mr. Szlapka's ability and probity.

Q. What organization was created to see that proper material was secured for the construction and that the shop work was in all particulars up to the requirements of your specifications and in accordance with your instructions?—A. There were inspectors appointed at the mills to inspect the crude material as rolled to see that it was up to the specifications and requirements. There were inspectors at the shop to inspect the mechanical work and to see that all the details complied with the approved drawings.

Q. Was this inspection properly part of the duties of the consulting engineer, and was the organization of this inspection in accordance with your advice? Were you satisfied that the inspectors appointed were, in all respects, the men best qualified for the position and if not, why and by whom were they appointed? Was your advice with regard to the local force required for inspection and charge of erection asked or did you find it necessary to offer advice on this point? Was this advice followed?—A. It was not properly the duty of the consulting engineer, and the organization was not in accordance with my advice. Long before any work of construction was started at the shops the chief engineer of the Quebec Bridge Company asked me in regard to the matter of the inspection, and I outlined the following programme, stating that the inspection of the shop work on this structure was far greater and more important than anything that we had had experience with before, that the features of the mechanical work were minor ones compared with the necessity of

watching all the technical features of the plans, and that technical engineers, if possible with shop experience, who could not only inspect this work in the mechanical requirements, but see that all the technical requirements of the plan and strain sheets were properly executed, should be employed. I expressed a desire that technical graduates should be appointed to the position of inspectors at the shops. I pointed out that after the erection work commenced we would need a highly developed class of men to take charge of that part of the work; it would be very responsible and very difficult to undertake, and that I hoped we could gradually weed out from those who were at the shop men who were competent to take charge of the inspection of the erection after it commenced. I also pointed out to the chief engineer of the Quebec Bridge Company that when this bridge was done and finally completed and turned over to the proprietors it would be necessary to have a competent body of engineers to have charge of the structure, its maintenance and general supervision, and that such men should be men who were thoroughly acquainted with the whole history of the construction, the whole theory of the work, and who would be able to know the thing as intimately as possible in order to maintain and take care of the structure properly. I stated that in view of this matter I thought it would be fair and proper that, if it were possible, these inspectors should be Canadians, graduates of Canadian institutions, because I stated that the men having charge of this work would have to live there, and they should be men of the country. I did not feel that Mr. Hoare was in sympathy with this matter, and I did not succeed in obtaining at that time the men I hoped for. At a conference at Phœnixville about the time the work was under way, the necessity of an inspector became imperative, and I stated that I was hampered, that the men's names that Mr. Hoare had sent me did not satisfy me sufficiently to have me recommend them, and that I had no real right to take up that matter. Mr. Reeves, the president of the Phœnix Bridge Company, stated at that time that Mr. Edwards, who is the present inspector, had been inspector at their shops for many years, and that they considered him a very competent man, that he was *persona grata*, and that he would recommend me to give him consideration. I had Mr. Edwards come to my office and examined into his history and found that some seventeen years before he had done some inspection for me that was satisfactory, and that he had been constantly an inspector from that time on, and I appointed him inspector at the shops, and so reported to Mr. Hoare. Later on, feeling the necessity of having some one qualified for the inspection of the erection, and failing to get any such person appointed, I heard of Mr. McLure, bridge inspector at that time on the New York, Ontario and Western Railroad. I sent for him and examined into his career. I found he was a technical graduate. I inquired into his ability to climb and his ability to express himself clearly in regard to technical matters, and I concluded that he was a desirable candidate for the position of inspector for the erection. I again took the initiative and appointed him assistant inspector at the shops, telling him what my ultimate purpose was, that if he proved himself, after a trial, competent, he should be the inspector of the erection. I sent him to the shops under instructions that while he was to give sufficient attention to the mechanical inspection to make himself thoroughly acquainted with the construction of the work, he should bear in mind that the principal duty that I wanted him to prepare himself for was that of inspecting the erection, that I wanted him to make himself thoroughly acquainted with all the strain sheets, not only of the work as it would finally be constructed, but especially the strains due to the erection; that I wanted him to be so prepared that when he went to the bridge he would know under every change daily made in the load what the effect would be upon all the members of that structure theoretically, and that it would be his duty to see that they practically met the expectation of the theory. I explained to him in a general way the camber necessity, the changes of position of the different members and the necessity of keeping careful and watchful eye on these actions and to know why these modifications were expected, and, when they did not occur, to find out why. I then privately requested Mr. Szlapka, the designing engineer of the Phœnix Bridge

Company, to give me all the aid he could in educating Mr. McLure for the position, and confidentially to give me his opinion of Mr. McLure's capacity after he had been there a sufficient time to determine it. Later on Mr. Szlapka reported that he found Mr. McLure very energetic, very active, very bright and thoroughly capable of undertaking the work that I had in view. I reported the appointment of Mr. McLure to the chief engineer of the Quebec Bridge Company (Mr. Hoare). The general impression left upon my mind after communicating with Mr. Hoare, was that he did not want Mr. McLure.' He even stated that he had other men in view. The work of erection had progressed to the extent of placing nearly all the lower chord of the anchor arm upon the falsework before Mr. Hoare called for Mr. McLure's assistance. He had previously to that, I would state, forestalled my action after I had appointed Mr. McLure by notifying me that he had appointed Mr. Kinloch inspector for the erection. Without any reflection upon Mr. Kinloch—all I have heard of him has been most favourable—I knew he was not qualified to do the duty that I expected of the inspector of erection. When Mr. Hoare sent for Mr. McLure finally, they were wedging out the lower chord for camber, something that I am thoroughly satisfied neither Mr. Hoare nor Mr. Kinloch understood. I think that was the reason for calling for Mr. McLure at this late day. Knowing that Mr. Hoare had already appointed Mr. Kinloch inspector for the erection, I felt it my duty to put Mr. McLure's position clearly to Mr. Hoare, so I gave Mr. McLure a letter of instruction, and addressed him as inspector in charge of the erection, Quebec bridge. I told him to present that letter to Mr. Hoare when he went to Quebec.

Q. How often did you personally visit the shops, and by whom and in what form were instructions given to the inspectors?—A. I am sorry to say after the work commenced I visited the shops I think but three or four times. I do not know to what extent Mr. Hoare may have given the inspectors instructions; I have given them from time to time verbal and written instructions. The shop inspectors' instructions have been almost entirely verbal, except on occasions when things would come up about which I felt it necessary to write a letter to the shop inspector. He was in the habit of coming to my office at least once a month, sometimes twice, but always once a month, to bring estimates of weights of material for my examination and approval. At such times he furnished me memoranda showing what had been done, and also drew my attention to points on which he wished my advice and instruction, so that largely my advice and instructions to the inspector at the shops were verbal. As to Mr. McLure, I know not what instructions he may have received from the chief engineer of the Quebec Bridge Company, but all my instructions to him while he was on the work were in the written communications of which the Commission have full copies.

Q. Were the records from the inspectors regularly transmitted to you and to whom did they refer for instructions in case of dispute or difficulty?—A. I think that is already answered except in regard to the records. Mr. Edwards made both verbal and written reports from time to time. Mr. McLure made regular weekly reports in regard to the work of erection and, to the best of my knowledge and belief, in all cases of dispute or difficulty I was the only person from whom they received any instructions.

Q. Was the workmanship satisfactory to you, or did you find it necessary to take decided action to secure satisfactory results?—A. In many directions the workmanship was perfectly satisfactory, but I had cause to make frequent complaints of the mechanical department, especially regarding the facing of the compression members and the boring of the pin holes.

Q. Did you find it necessary to take decided action to secure satisfactory results?—A. Unfortunately I did not know the unsatisfactory results until after they were made. I did frequently and strongly express my dissatisfaction with the faults that were made, and I did also require that all such faults should be corrected to put the work into a satisfactory shape. Whether that was done I have no personal knowledge, except the reports from the Phœnix Bridge Company and the inspector. During

the erection, on June 2, 1906, Mr. McLure reported that when preparing to erect the centre posts he found the bearings of the upper parts of this post were not true and straight and sent me sketches which indicated very bad shop workmanship. I instructed him to stop the erection until this was properly corrected and remedied. He reported later that this work had been corrected in accordance with my instructions. Of course, I do not recall, and it would be perhaps unnecessary, each individual case where errors occurred. They are all on record and can be found from the files, but I could not refer to them without devoting a good deal of time to going over the records, and I do not think it would be important in the line of testimony except to show that the workmanship was not entirely satisfactory to me, especially that part that I have mentioned.

Q. Are you fully satisfied with the steel that has been supplied for this bridge and does its action both when under test and in the wreck indicate thoroughly good material ?—A. I think it has been shown both under tests in the testing machine and the test of the failure, as far as I can judge by the reports of the failure, that the material is unquestionably most excellent.

Q. Did the magnitude of the structure call for much better workmanship than is usual for ordinary bridges and was any effort made to secure such superior workmanship ? Was the workmanship defective in any particular ?—A. I most decidedly think it did demand a higher class of workmanship than that employed in ordinary bridges, and I do not think that in all matters proper efforts were made to secure such workmanship, particularly in reference to the two points I have previously mentioned, the facing of the compression members and the boring of the pin holes.

Q. Who devised the method of loading and unloading the members and all provisions for transportation, and under what supervision was this work carried on ?—A. It was entirely within the hands and under the control of the Phœnix Bridge Company.

Q. Was the deformation of these members while in transit probable ?—A. Yes, under careless treatment or in the case of accidents.

Q. Whose duty was it to ensure that the erection methods and appliances were suitable to the work and to organize the system of erection ?—A. The Phœnix Bridge Company's. At the same time I had in a general way, but not in detail, to consider the methods they intended to employ and I believe that great care was employed by the Phœnix Bridge Company in devising an excellent method of handling the material and putting the same in place.

Q. Was the inspection of the work of erection and the taking charge of that work properly part of the duties of the consulting engineer and, if not, whose duty was it ?—A. It was not the duty of the consulting engineer. It was the duty of the chief engineer and his organization, with the sole right to apply to the consulting engineer for advice upon any special problem.

Q. Was the local staff at Quebec, employed by the Quebec Bridge Company and the Phœnix Bridge Company, to your satisfaction and did you consider it fully competent to handle the work?—A. Not from my present knowledge. When discussing the necessity of technical men for the inspectors, I took the matter up with the chief engineer of the Phœnix Bridge Company and pointed out to him not only the necessity of the Quebec Bridge Company having competent men in charge of erection, but also the absolute necessity for the Phœnix Bridge Company to have an engineer on the work at all times who was fully cognizant of the details of the structure, the action of the different members under the different strains and camber movements and who would have the technical knowledge to take action if, at any time, the theoretical expectations should not be obtained, to determine why such result was not obtained and be able to direct the necessary corrections. I do not think, from my present knowledge, that the Phœnix Bridge Company did have any such engineer upon the work.

In regard to the local staff of the Quebec Bridge Company, I have no knowledge further than in reference to the chief engineer and Mr. McLure, and I feel now that on the part of the Quebec Bridge Company, Mr. McLure was the only person who had any preparation or qualifications for supervising the construction of that bridge, and I know that the time allowed him for preparation for this important duty was not

as great as should have been given him. From the reports that he has from time to time sent me, from personal intercourse with him, I feel that he did all that could be expected of him under the circumstances.

Q. By whom were its members appointed and to whom were they responsible?—I have already explained the method of the appointment of Mr. McLure, the only one in regard to whose appointment or selection I have any knowledge.

Q. By whom was this force paid?—A. I presume by the two companies, that each company paid the staff employed by it at Quebec.

Q. Please state what qualifications in the way of training, age and experience were necessary to make a man fit to have supreme local control of the erection of this bridge and whether any of the staff employed by either the Quebec Bridge Company or the Phœnix Bridge Company had these necessary qualifications?—A. For a man to be qualified, in my opinion, to have the supreme local control of the erection of a bridge as important as that under consideration, I think he should have been a thoroughly technically educated and experienced bridge engineer. I regret to say that I do not think the chief engineer of the Quebec Bridge Company had these qualifications. In reference to the local control by the Phœnix Bridge Company, as stated before, I do not think they had the quality of engineer that the curcumstances demanded. In saying this I do not wish to reflect in any manner upon Mr. Birks, who sacrificed his life and who undoubtedly was a competent man in his line of experience; but I do not understand that he had the thorough training and knowledge of all the requirements of this structure necessary to fit him for the responsible position as the engineering representative of the contractor on such an important structure.

Q. Is it reasonable to expect that emergencies of grave importance may arise upon work of such character and magnitude and could the local staff of the Quebec Bridge Company be considered to be reasonably complete without including an engineer of sufficient scientific training, age and practical experience to be competent to deal with any such emergencies?—A. I have practically answered that already. I do think that emergencies of grave importance are liable to occur in the erection of such a great work and the history shows that they have occurred, and, as I stated before, I do not think that the local staff contained a man of sufficient scientific training, age and practical experience, to have met the emergencies.

Q. To what do you attribute the employment of a staff not equal in calibre to the difficulties of the undertaking, on the part both of the Quebec Bridge Company and of the Phœnix Bridge Company?—A. This is a rather difficult question for me to answer. I suppose that in the case of the Quebec Bridge Company, like all projects undertaken by men not specially acquainted with the necessities, the engineering features of any such great work, they were unable to make a proper selection. In reference to the Phœnix Bridge Company, I think it was due to the fact that the commercial branch of that company gave more consideration to the pushing and completing of the work than they did to the giving of due consideration to the practical requirements of such a great structure.

Q. Do you consider that it is a wise practice when building a bridge of novel character and unprecedented dimensions to place the design of the structure and of the methods of erection in the hands of the mechanically trained staff of a contracting company and, if not, why was this practice allowed in this case?—A. In answer to this question, it is the general practice in America to have the mechanically trained staff of contracting companies prepare the working plans. As a rule, no engineer could afford to maintain a staff of such character, and no corporation would listen to a fee that would cover any such expense.

Q. Were the methods of erection submitted to you for approval or were you in any way advised of these methods and of the character of the plant that was being provided for the erection?—A. They were submitted to me unofficially, not for my criticism, nor that they came within my authority, but for personal interest.

Q. What authority had the engineers and inspectors of the Quebec Bridge Com-

pany to order changes in these methods or to interfere with the progress of erection? —A. They had all the authority that belongs to a chief engineer and his staff, the authority that belonged to their offices.

Q. Was it fully understood that the execution of this work was at all times subject to their approval?—A. I think that is implied in the office of the chief engineer. In my instructions to Mr. McLure, as far as his authority went, he was distinctly instructed to see that no undue risks were taken, and that all the work was satisfactory before it was finally left.

Q. How often did you visit the bridge site during the erection of the superstructure?—A. Never. I have never been able to visit the bridge since the erection commenced. I was disabled before that was undertaken.

Q. By whom and how often were you advised of the progress of the work and of matters of interest connected with it?—A. Mr. McLure made me weekly reports detailing pretty clearly, and apparently thoroughly, the progress and the occurrences of the previous week, and he occasionally sent me an additional special letter when something would occur that he thought should have more prompt attention than a matter contained in the weekly report.

Q. Did you find it necessary to interfere with the conduct of the erection, and if so, what were the circumstances of such interference —A. As narrated in a previous answer, I stopped the erection of the centre post until it was made satisfactory. In the latter part of September, 1906, on receipt of Mr. McLure's letter of September 22, 1906, and letters following, it was made clear to me that the anchor arm was not acting in accordance with the theoretical expectations. On studying the detailed reports of Mr. McLure and the levels contained in his reports, I found that instead of the anchor arm working itself free from the false work near chords 8, 9 and 10 first, as it should have done, it was showing a tendency to lift at the far shore end. This was so anomalous that I sought for the reason thereof, and I came to the conclusion that they had not considered the compression of the main centre post under the additional load of the cantilever arm; that this was throwing an undue load upon the bents near point 9 of the anchor arm, and without giving at that time, September 24, any positive orders, I drew Mr. McLure's attention to this point, believing that he and the engineer of the Phœnix Bridge Company were also watching for these contingencies, and would take the proper action to remedy the difficulty. It appears that nothing was done by the Phœnix Bridge Company until several weeks later, when in an interview with Mr. Szlapka at my office, I showed him the correspondence between Mr. McLure and myself, and pointed out what I considered to be the difficulty. He acknowledged the theory upon which I was working, and I believe that he that day did send orders to Phœnixville to take the proper steps to relieve this undue strain at this point. There was some friction between Mr. McLure and the superintendent of erection in reference to this matter, which will be found in the correspondence, indicating that the Phœnix Bridge Company did not recognize the rights of anybody except themselves to control the erection. That point was brought up in a later discussion with Mr. Szlapka in an amicable way, and I distinctly told him that the Phœnix Bridge Company were not the only parties who had financial interest in this structure, that the parties whom I represented, the Quebec Bridge Company, had paid for the structure as it stood, that it belonged to them and they had an interest in seeing that it was not risked or injured, and while I always endeavoured to get along amicably with everybody, if it came to a point of determining my right or the right of any employee under me to protect the property of the company, I thought they would find themselves in the wrong. I think the correspondence will further illustrate all that without my going further on that point.

(*Note.*—The correspondence here referred to is marked Exhibit 68.)

Q. Do you think that the leaving the position of this chord at that time, with the falseworks not lowered to their proper position, could have produced any injurious effects near or about lower chord 9 of the anchor arm?—A. That an undue and an

unprovided-for strain was produced by this neglect seems very possible to my mind, especially considering that at that time the splices, which were the weakest and most hazardous portions of the structure, were not riveted and perhaps not fully and properly bolted.

Q. Was appeal to you for assistance and advice in the face of difficulties ever made by the Phœnix Bridge Company?—A. That I suppose I could answer by saying that Mr. Szlapka and myself were in frequent intercourse discussing and considering many points as they occurred.

Q. Was it the practice of the Quebec Bridge Company's staff to refer all difficulties to you, and, if so, what were the duties of the chief engineer?—A. As far as I know all difficulties, all questions, all decisions on any matter relating to the structure were referred to me, and practically, as I now see it, I was acting not only as the consulting engineer but as the chief engineer of the Quebec bridge.

Q. What was the agreement between yourself and the Quebec Bridge Company as to your remuneration for your personal services and expenses, and under what circumstances was the original arrangement amended? Did the Quebec Bridge Company allow you anything for the necessary staff of assistants? What proportion of your fee have you had to expend for assistance in the interest of the Quebec Bridge Company?—A. At the original interview where I made the offer to undertake the examination of the competitive plans I was asked what my fee would be to act as consulting engineer when the work was started. I stated that my fee would be $7,500 a year for such services. I did not recognize at that time that there was to be any expense except an occasional visit to Quebec, so that I made no agreement regarding expenses. In August, 1901, being in Quebec and my fees backward in payment, finding that the company apparently were embarrassed for funds and considering that under the circumstances then before me it might be some years before any actual and important work would be required from me as consulting engineer, I wrote a new offer which amounted to reducing my fee to one-half. A member of the board suggested at the time to make it the round sum of $4,000 instead of the one-half which I had offered. That amount has been paid to me up to the commencement of this year. When other duties than those of the consulting engineer began to be placed upon me, I suggested to Mr. Hoare that it was hardly fair, considering that I had reduced my fee to one-half, that I should not be granted some additional remuneration to aid me in carrying out the duties that had been placed upon me. No such additional remuneration has ever been granted me, and no offer has ever been made to restore my original fee. My staff and office expenses due to the work required in the interest of the Quebec Bridge Company have been paid entirely from my own fee, and they have amounted to approximately the sum that I have received from the Quebec Bridge Company to cover my employment.

Q. Did the officers of the Phœnix Bridge Company fully appreciate the engineering difficulties connected with the undertaking, and did they willingly and immediately make good all defects that were brought to their notice?—A. I think the technical staff as represented by Mr. Szlapka and his subordinates did fully appreciate the engineering difficulties connected with this undertaking, but I do not think that that branch, which might be called the commercial side of the Phœnix Bridge Company, were willing to or did make good defects that were brought to their notice until they were compelled to, when compulsion was applied. When the elongation of the eyes of the eyebars under the strains that we were intending to employ was brought to my notice by certain preliminary tests, feeling it to be a matter of serious moment to know the truth, I urged the Phœnix Bridge Company to make a thorough investigation of this subject, and suggested to them that as it was a matter of special interest to all bridge construction, they should enlist the co-operation of other bridge companies in making a thorough examination into the whole problem. After more or less discussion it was made clear to my mind that the Phœnix Bridge Company were more desirous of hiding the matter than they were of exploiting it. I was asked not to make the matter public. Finding this to be the position, on January 8, 1905, I wrote to Mr.

Edwards, the inspector at Phœnixville for the Quebec Bridge Company, directing him to accept no more eyebars for the Quebec bridge until further orders, and directed him to furnish a copy of this letter to the Phœnix Bridge Company. Then the Phœnix Bridge Company showed eagerness to carry out the investigation that I demanded, and did carry it out to my satisfaction.

In other matters from time to time I did find them sluggish in making corrections or remedying defects. To come down to a later date, on August 6, 1907, Mr. McLure reported the condition of chord 7 and 8, cantilever arm, and the method of remedying proposed by the Phœnix Bridge Company. Upon the receipt of this letter from Mr. McLure on August 8, I immediately telegraphed the Phœnix Bridge Company that the method was not satisfactory and asked them: How did this occur? The following correspondence containing my letters to Mr. McLure and Mr. McLure's letters to me, my correspondence to the Phœnix Bridge Company and their replies to me, all of which are consecutive, indicates that the Phœnix Bridge Company did not desire to make any corrections of importance, did not desire to put this chord in a safe condition, tried to convince me that the error was unimportant, and even tried to explain that the error had always been there. Before I could take final action as I had fully prepared to do at the time, the more serious problem of the bending of chord 9, anchor arm, was reported to me.

Q. Was due care exercised throughout in the handling of the bridge members?—A. For that information, gentlemen, you will have to depend on the testimony of other persons. I judge, however, from results reported to me, that there was not due care at certain times.

Q. Are you aware of any cases in which members were damaged in handling?—A. It is now before the commission in evidence that chord 9 was damaged in handling.

Q. Are you aware of any cases in which the connections between members in place were not fully made?—A. It would appear from the evidence and from the records of Mr. McLure, that the splices of the lower chords were not fully made or properly considered.

Q. What deviation of a rib of a main compression member from the straight would be passed in first-class inspection, and what variation from the true plane is permissible in the faced ends of the ribs at butt joints?—A. It is impossible to draw any general and definite rule that applies to all cases. There must be a certain amount of engineering judgment applied to each special case, but I should consider that in a general way, bearing in mind the compression chords of this structure, that any deviations from a straight line corresponding to the axis of the member exceeding half an inch would not be good, and if this amount of deviation is only for a short length it becomes far more serious. In regard to the amount of error that might be permitted in facing the ends of compression members, bearing in mind the large dimensions of those in this structure and the importance of having the best workmanship on account of the high demands made on all parts of the structure, I should think that one-sixty-fourth of an inch variation from a straight line on the full width of the lower chord would be the extreme limit that should be permitted.

Q. Where these limits have been exceeded in the Quebec Bridge members do you consider that the fault lay with the shop inspection or that the distortion might be due to insufficient care in handling?—A. Both or either.

Q. Would such faults materially weaken a compression member?—A. Any departure from a perfect fit or straight line in a compression member does weaken that member. How much, of course, depends upon the relative departure from the true lines.

Q. Was the progress of the riveting such as you desired that it should be at the various stages of erection?—A. To the best of my knowledge it so appeared.

Q. Why was the south half of the suspended span to be erected in 1907 when the north half, in all probability, could not be erected until 1909?—A. Simply because

the material was there, the tools were there, and it was undoubtedly perfectly proper to complete that portion of the work while they had it in hand, everything else being satisfactory.

Q. Was your approval of this procedure requested or obtained and, if not, was this procedure in your judgment good practice?—A. The matter was discussed, and I considered it perfectly proper and good practice.

Q. Who authorized the commencement of the erection of the suspended span before the large traveller was taken down? Was it understood that this was to be done and did this procedure have your approval?—A. In the early stages of the erection, long before the large traveller was passed over to the cantilever arm, I drew Mr. Szlapka's attention to the undesirability of using the large traveller for erecting the suspended span, pointing out that it was unduly hazardous and was unnecessary for various reasons which we discussed. He agreed with me and agreed to have a small traveller designed for the purpose of erecting the suspended span. The small traveller was designed and they then appealed to me that it would be necessary to use the large traveller for the purpose of erecting the small traveller into position. I gave my consent to that being done, but it was clearly understood that as soon as the small traveller was erected, the big traveller would be removed from this structure and that the erection of the suspended span would be continued with the use of the small traveller only. I was under the supposition that the large traveller was being taken down, I knew they had commenced to take it down, and I was very much astonished when I found that they were continuing the erection of the suspended span with the use of the small traveller and most of the weight of the large traveller still at the extreme point of the cantilever arm. This knowledge, however, only came to me after the failure of the structure.

Q. From your present knowledge what do you consider the weakest and most hazardous part of the design?—A. Unquestionably the splices of the lower chord. While, from the appearance of the wreck these splices when properly and fully rivetted were the strongest part of the compression chord, when unrivetted or improperly bolted they were in a condition of great hazard and uncertainty. As these splices in the anchor arm could not be rivetted until the camber action had taken place and the joints had come to full and proper bearing, they were, if improperly stayed and bolted, very dangerous points and should have been most carefully watched and protected. From the report of the condition of splice 7-8, cantilever arm, which is contained in Mr. McLure's and other correspondence following August 6, 1907, there was first made clear to me the seriousness of these splices and the lack of appreciation of the necessary care to be given them by the Phœnix Bridge Company.

Q. Do you consider that the initial failure took place in the lower chord ?—A. I feel thoroughly satisfied, with the history now before us in regard to chord 9, west anchor arm, that it was the initial point of failure.

Q. Were you satisfied with the care and intelligence shown by the Phœnix Bridge Company in placing the members of this chord?—A. I think I have answered that already when I have spoken of their lack of caution in staying and protecting the splices of this lower chord. With the facts before us, seeing their lack of appreciation and consideration of the splices at 7 and 8 cantilever arm, there is grave suspicion in my mind that similar neglect and lack of appreciation may have prevailed before.

Q. At what date did you first become uneasy about the lower chord members?—A. On August 8, 1907, upon the receipt of Mr. McLure's letter, as I have before mentioned, narrating the condition of splices in chord 7-8, cantilever arm.

Q. Starting from this date please relate all the circumstances in which you were personally concerned up to the time of the failure, referring to all communications that reached you and all action that you advised?—A. I have already stated and drawn your attention to the correspondence between the Phœnix Bridge Company, Mr. McLure and myself, following August 6th. On the morning of August 29, on reaching my office somewhere about 11.25 o'clock, I found Mr. McLure at the office. After speaking to him I passed to my office and took up my morning mail among which was

the communication of Mr. McLure narating the condition of chord 9, west anchor arm. After carefully reading and considering the letter, I called Mr. McLure into my office and cross examined him to find out whether the facts given were actual or whether he had been scared, and satisfying myself that the data there was from actual measurement and actual observation, I said: 'It is very serious.' He said: 'Mr. Cooper, they have moved out the small traveller, but we have estimated that it will not add to the strain on chord 9 more than 50 lbs. per square inch, but they are going on this morning to erect more of the work; do you think that is right? I said: By no means right. I said: Is Mr. Milliken on the work?—intending to immediately telegraph orders to Mr. Milliken to stop it. No, he said,Mr. Milliken is not present on the work; there is only a foreman present. Well, I said, I do not know whether a foreman would take a suggestion from me or not; I will have to telegraph immediately to the Phœnix Bridge Company for them to wire to the bridge. I said: Are you sure that the Phœnix Bridge Company have these same facts before them that you have presented to me? and he said: Exactly the same report has gone to Phœnixville that you have now received. That was confirmed by a telegram handed me about the same time from Mr. Hoare, stating that Mr. Birks had received a telegram from Phœnixville stating that this chord had been bent before it left the shop. Satisfied then that the Phœnix Bridge Company had the same facts I immediately telegraphed them to 'add no more load to bridge till after due consideration of facts.' I then said to Mr. McLure: You must go to Phœnixville immediately and tell the Phœnix Bridge Company that I do not want any delay such as that involved in the discussion that we have had heretofore on similar occasions, but I want immediate action to strengthen that chord and to protect the bridge. He pulled out his time table and said: Mr. Cooper, I cannot reach Phœnixville before five o'clock. I then added to the despatch: Mr. McLure will be over at 5 o'clock. Mr. Berger went to the Western Union office and they have the telegram endorsed: 'Sent from the Western Union office at 12.16 p.m.' I immediately took up the problem of how to protect and how to strengthen that chord and made some sketches which I showed to Mr. Berger. I said: If the Phœnix Bridge Company do not themselves adopt some better method I would suggest that to them. At 9 o'clock that evening I was called up on the long-distance telephone, and Mr. McLure reported that the bridge was in the river.

Q. Where do you think that the first failure took place and in what manner do you think the bridge acted during the fall?—A. Considering the history of chord 9, which is before the Commission, there is no doubt in my mind that chord 9, west truss, failed first, and after it passed a certain degree of flexure the lattice bars in the centre of the chord were perhaps what first gave way. To my mind, the noise that the men first heard was the explosion of the lattice bars of chord 9 at the centre. Unrestrained by the lattice the webs of this chord undoubtedly buckled together as so many sheets of paper crushed in the hand. When chord 9 had passed a certain point the lateral braces between that truss and the opposite truss in that panel were disabled from doing any staying duty. It appears to me, then, necessarily that the opposite chord 9 east truss, must have given way even had it been far stronger than it actually was. With the giving way of chord 9 west, immediately followed by the failure of 9 east, the cantilever arm would naturally deflect towards the river. The evidence of the wreck, showing the continuity and unbroken condition of the eyebar top chord, and that the anchor towers and anchor bars which were vertical in position before rupture were pulled out to a horizontal position, indicates clearly to my mind that the main towers must have remained intact until this was done—indicating that the main towers and the whole of the anchor arm declined towards the river and downwards until either the main towers slipped from their footings or the great strain of this long eyebar chord produced the final rupture of the main towers. That the great mass of fallen material moved several feet towards the east was due to the probable action and later rupture of the eastern truss, which would produce a tendency to drag the material towards the east.

Q. Do you consider that there was clear indication that the failure was imminent and was it possible, by prompt and intelligent action, to have prevented the failure? —A. I think the deflection of an important member, as chord 9 west, to the extent of 2¼ inches would indicate to any intelligent mind that that chord was less capable of doing the duty that it would have done if in a perfectly straight condition, and I do think that it was perfectly possible by prompt and intelligent action to have stayed that chord and prevented the failure of the bridge.

Q. By whom should the orders for such action have been given and to whose lack of judgment and initiative can the failure therefore be charged?—A. To the executive officers of either company who were present or within sufficient touch to have given any orders.

Q. In your opinion, is it good practice to leave the ordering of such action to any employee of a contracting company?—A. The contracting company should have had on the structure an employee of sufficient intelligence to have appreciated the necessity for and to have given such an order. At the same time, the responsible executive of the Quebec Bridge Company should not have hesitated, in the absence of proper action by the contractor, to have given such an order.

Q. Do you think that at moderate expense the ribs could have been made absolutely safe?—A. I do. I believe if prompt action had been taken to protect chord 9 west from further deflection, which could have been done by the employment of three hours' work and $100 worth of timber and bolts, the defects and deficiencies which we now recognize in the compression chords and members, could, at a later date, have been corrected and the bridge could have been made perfectly safe and efficient for its intended purpose.

Q. Do you consider that the engineering data at our disposal are sufficient to enable engineers to design members similar to those in the lower chord with safety and economy? Would you now recommend any material changes in the detailing of these or any other members, and, if so, what would these changes be?—A. My responsibilities, gentlemen, end as soon as I have served by duty of aiding you in reaching the truth in regard to the destruction of this bridge. While I have my views and such views are at the service of those who have heretofore relied on me, I shall decline to take any executive or responsible position in connection with the correction of the errors that we now recognize in this work; it must be referred to younger and abler men.

From October 23 to November 22 the Commission was engaged in taking evidence and collecting information in Philadelphia and Phœnixville.

I, Ellsworth L. Edwards, of the town of Pottstown, in the state of Pennsylvania, one of the United States of America, bridge inspector, make oath and say:—

1. That I attended before the Board of Royal Commissioners appointed under the great seal of Canada for the purpose of inquiring into the causes of the collapse of the Quebec Bridge, on several days during the months of October and November, 1907, in the town of Phœnixville, in the state of Pennsylvania aforesaid.

2. That the attached six pages, numbered 857 to 862, both inclusive, contain my present evidence in this matter; the answers to the questions are true statements to the best of my knowledge and belief.

Sworn before me, in the city of Philadelphia, in the state of Pennsylvania, this day of November, 1907.

Mr. EDWARDS' testimony.

Q. Please file complete list of shop errors detected by the inspectors and indicate those which were specially brought to the notice of Mr. Cooper?—A. Herewith I file

with you a book (Exhibit 84) which contains memoranda of all the errors discovered at shops by inspectors. Those marked with an X in red were specially brought to Mr. Cooper's attention, for the most part on the occasions of my frequent visits to his office. Minor errors were sometimes referred to in the course of my conversation with him.

Mr. Cooper had advised me to confer with Mr. Szlapka regarding minor errors. This I did and before the shop was allowed to remedy such errors Mr. Szlapka was consulted. In matters affecting clearances his advice was particularly valuable.

My method was to exchange ideas with Mr. Szlapka as to the remedying of these less important errors and come to a conclusion satisfactory to us both. While such minor errors were not then brought to Mr. Cooper's attention it was my understanding that he approved of this course.

Q. Please file a list of errors which were not detected in the shop inspection and which were subsequently detected and reported from the field?—A. I do not have a complete list of errors found in the field and which were not detected in the shop. Mr. McLure wrote me concerning some of these, but I understand you have this information in detail in his book labeled 'Record of Shop Errors found in the Field.' This record includes the errors of drawings as well as those of shop and a distinction is made between these two classes.

As you are probably aware errors of drawings are not chargeable to inspectors, as drawings are supposed to be correct when received by us.

Q. Was every important error that you detected reported to Mr. Cooper and were his instructions in regard to these errors promptly carried out?—A. Every error which I considered of sufficient importance was referred to Mr. Cooper, and his instructions were carried out implicitly. Members for the south side were always remedied very promptly. As there was no hurry for those of the north side these were not attended to with such promptness but were finally remedied or passed by Mr. Cooper.

Q. Please refer to your letter of February 26, 1906, to Mr. Cooper and explain in detail the conditions you therein described in the second paragraph?—A. In reference to the second paragraph of my letter of February 26, 1906, to Mr. Cooper, I would say that at that particular time there seemed to be an unusual number of errors being made both at the bridge, shop and the eye-bar plant, and we were endeavouring to get things back to a normal condition. Notwithstanding the efforts being made errors continued. Such conditions were only temporary and as stated in this same letter 'We expect better results before long.' And these were obtained.

My reference to 'being up against a pretty tough proposition' means that new errors were appearing in spite of precautions which were being taken by the Phœnix officials and ourselves.

It is my experience that there are occasional short periods when an unusual number of mistakes occur and, vice versa, there are periods when unusually few errors are made.

Q. Within what limits do you consider it practicable to straighten the ribs of bottom chord members, and of the main posts, and how closely can the ribs of consecutive chord members be made to match each other?—A. In reference to the limits considered practicable to straighten ribs, I would say that this depends to a large degree on the thickness of these ribs and also the nature of the bend. If the bend is a long curve it is a comparatively easy matter to take out a 3-inch to 4-inch bend, but if the bend is a short 'kink' this would be a different proposition and could only be decided by the case at issue.

However, we are not aware of any chords on the Quebec Bridge where it was necessary to remove any short or sharp kinks. Long bends were always removed before milling.

In the matching of consecutive chord members it must be taken into consideration that the web plates may vary in thickness and angles are not always true (viz.: one leg not at exact right angles to the other). Our practice in inspection was to endeavour to have the ribs absolutely the correct distance apart from top to bottom at ends of chords. We did occasionally allow as much as $\frac{1}{16}$-inch (max.). I do not believe it is

possible to secure greater accuracy than this where measurements are taken between *rolled* surfaces.

Q. How closely to true plane will the large rotary planers cut ?—A. From actual measurements we know that the accuracy of the milling done by the rotary plane for the larger members of the Quebec Bridge varied from a true plane, where such variation occurred, from one-sixty-fourth to one-thirty-second of an inch. This was the best the machine could do.

Q. We understand that a post section was found 3/64-inch out of true on one corner, and that this was accepted on the ground that the planer could not cut within these limits. Is this correct and was this reported to Mr. Cooper ?—A. Regarding main post section found to be out of true 3/64-inch at one corner, the fact of the bearing surface being so great and the unevenness in question being so small and at one point only I deemed it advisable to accept the member, believing that when the weight of other post sections was on there would be perfect contact. It is a question if any better results would be secured by remilling a section so slightly imperfect over so small an area, and by remilling we would be reducing the thickness of bearing surfaces. This error was not reported to Mr. Cooper so far as I now remember.

Q. Were any full size tests of plates, angles or built up members made during the fabrication of the work ?—A. Some tests were made of built up members to represent the ears of posts and hangers. The results of these tests are produced (Exhibit 85). Dwg. 2—T.O. 267.)

No full size tests of angles or plates were made.

Q. Please file a statement giving the particulars of all full size, eye-bars tests and specimen tests of the materials of which they were made.—A. I produce a statement as asked. (Exhibit 86.)

Q. State exactly what tests for accuracy were made upon each of the main members and how were these tests made, not only as to dimensions but as to the setting of the pieces in the machine ?—A. In reference to tests for accuracy, the facing was first tested with steel straight edge. Dimensions from faced end to centre of pin holes were taken by means of a standardized tape secured at one end of member by a stop and supported at points the entire length of piece. To determine the exact centre of pin hole, a circular leaden disc was held in place by three set screws and the exact centre was established from four points on the bored surface of pin hole.

A spring balance was attached to the tape and 12 pounds tension used in all cases. In measuring distances less than 15 feet from C to C of pin holes the centres above described were put in but trammel points were used to check distances in place of tape.

Cast-iron gauges about 6 feet long were put in all pin holes. Care was taken to see not only that the pin would enter the hole without difficulty when the member was erected in the field, but that the allowed clearance between pin and hole was not exceeded.

While all holes for splice plate connections were drilled from iron template, the dimensions between holes were always all carefully measured and, in fact, this was done in the case of all open holes.

As to the laying out of members and setting same in machine it is not customary for inspectors to check these operations. It is the duty of the shop foreman to attend to such checking, but notwithstanding the custom we did (at Mr. Cooper's suggestion) check the laying out and the boring in many cases in order to reduce the liability of error.

Q. On May 3, 1907, Mr. Hoare asked you for another set of strain sheets for anchor and cantilever arm, and states that he is aware that the strain sheet for the suspended span was not then ready; was there any work on the suspended span at that date in the shops ?—A. Yes. the eye-bars for the south half of suspended span, about one-half of the material for panel one south side and some stringers were completed by May 3, 1907.

I, David Reeves, of the borough of Phœnixville, in the state of Pennsylvania, one of the United States of America, president of the Phœnix Iron Company, make oath and say:

1. That I attended before the Board of Royal Commissioners appointed under the Great Seal of Canada for the purpose of inquiring into the causes of the collapse of the Quebec Bridge, on several days during months of October and November, 1907, in the borough of Phœnixville and city of Philadelphia, in the state of Pennsylvania aforesaid.

2. That the attached eleven pages, numbered 864 to 874, both inclusive, contain my evidence in this matter. The answers to the questions are true statements, to the best of my knowledge and belief.

Sworn before me in the city of Philadelphia, in the state of Pennsylvania, this day of September, 1907.

Mr. DAVID REEVES' testimony.

Q. What is your position in the Phœnix Bridge Company and from what date have you occupied that position?—A. I am president of the Phœnix Bridge Company and have been since 1884, and prior thereto, from 1872, I was a member of the bridge building firm of Clarke, Reeves & Company, who were the predecessors of the Phœnix Bridge Company. Mr. Thomas C. Clarke, past president of the American Society of Civil Engineers, and Mr. Adolphus Bonzano, member of the society, and at one time vice-president and chief engineer of the Phœnix Bridge Company, were my partners in that firm.

Q. Who are the other officers of the Phœnix Bridge Company and what are their duties?—A. Mr. John Sterling Deans is chief engineer. Mr. Frank T. Davis, treasurer, and Mr. Wm. H. Reeves, general superintendent. The duties of the president and treasurer are those usual to such officers of a corporation. The duty of the chief engineer is to make contracts, to be in charge of the design and construction of bridges and other structures entering into the business of their transportation and erection, and to do and perform all other necessary things in connection therewith. The duty of the general superintendent is to take charge of the work in the mills and the shops until delivered upon the cars.

Q. Is the Phœnix Bridge Company a manufacturing company at all, or is it entirely a contracting company, and is it entirely separate from the Phœnix Iron Company? State the relations between the companies?—A. The Phœnix Bridge Company is an engineering and contracting, not manufacturing company. It is entirely separate from the Phœnix Iron Company. It has an arrangement with the latter under which its bridge and other structural work is manufactured in accordance with requirements. Formal methods of accounts, charges and payments are administered between the two companies precisely as in other contracts.

Q. Who is president of the Phœnix Iron Company? Who are the other officers of the company and what are their duties?—A. I have been president of the Phœnix Iron Company since 1888. Mr. George C. Carson, jr., is treasurer, and Mr. George Gerry White, secretary, all having the duties that usually pertain to these officers in corporations.

Does the Phœnix Iron Company provide material for and carry out the manufacture of all work under the contracts made by the Phœnix Bridge Company?—A. The Phœnix Iron Company provides the materials and fabricates the shop work in its mills and shops in accordance with the specifications and plans furnished by the Phœnix Bridge Company under its directions.

Q. Is this under a regular standing arrangement, or is there a separate arrangement made for each piece of work?—A. This is done under an arrangement standing since 1884, and prior thereto, with the predecessors of the Phœnix Bridge Company, the said firm of Clarke, Reeves & Company.

Q. What, if any, was the arrangement made between the companies in respect to the Quebec bridge?—A. The work embraced by the Quebec bridge was done under the regular standing arrangement.

Q. After Mr. Cooper reported favourably upon your company's proposal in 1899, had you any assurance from the Quebec Bridge Company that if the project were carried out your company would be the contractors, and, if so, what was the nature of your information?—A. No. The next step after the favourable report was the tender of the contract to the company by letter of Mr. Parent, president of Quebec Bridge Company dated 23rd of August, 1899, copy of which is filed as 'Exhibit 87.'

Q. Did you consider that the financial standing of the Quebec Bridge Company was suffiicently good to justify either the Phœnix Bridge Company or the Phœnix Iron Company in making serious expenditure in preparation for the construction of the main spans before you felt assured of the passing of the guarantee legislation by the Dominion Parliament in 1903?—A. We believed that the Quebec Bridge Company was either strong enough or had the means of becoming so to warrant us in making the expenditures for the construction of the main spans.

Q. Please state in detail what these expenditures were, if any, and when incurred.—A. It first became necessary to more fully design the bridge, to make some experiments respecting the eye bars and other shop work, and to obtain certain requisite tools. All of this was done as will be stated by those who were in charge of the several departments. The expenditure in tools amounted in the aggregate to over $200,000.

Q. Was there any delay, after the signing of the contract, in the preparation of plans and, if so, for what reason?—A. There was no delay of any kind after signing the contract in the preparation of the plans, the whole work proceeded with the utmost diligence.

Q. Did you keep in touch with the work as it proceeded; with what matters did you more especially concern yourself and, in view of what has occurred, will you please state fully all the circumstances of your own knowledge and your comments upon them?—A. I kept in touch with the work at all stages of its progress. I fully appreciated its magnitude and importance, the engineering difficulties involved, and the necessity of the highest class of workmanship in all members of the bridge. I believed the appointment by the Quebec Bridge Company of Theodore Cooper as consulting engineer assured the success of the undertaking, that our engineers and constructors were fully competent to design, construct and erect the bridge under Mr. Cooper's supervision and that of the engineers of the Quebec Bridge Company and of the Department of Railways and Canals. Mr. Cooper insisted upon reserving to himself the final authority over his colleagues, and I especially regarded his approval of the detailed drawings as of the highest importance, believing that with the details and sections of the bridge members approved by him, as well as the general procedure in shop and field, a perfect organization existed. I never suspected he was overworked, and I believed he would have been allowed any assistance asked for. I was advised that the Department of Railways and Canals intended to appoint an assistant engineer with a staff to actively co-operate with him, but was prevented at Mr. Cooper's imperative demand. I directed that all the special tools required in the shops, and all the special appliances needed for erection, be procured of the best types regardless of cost; and this resulted in the installation of every needed tool and an expenditure for these purposes of several hundred thousand dollars more than had been anticipated. I also directed that all the special tests advised by the consulting engineer, Mr. Cooper, or by our own engineers, arising from the unusual size of the bridge be promptly and fully made. This was done, and a full size model of the complete main panel point was built as a study before the templates and shop work were started, and other models of large size were also used for the purpose of instructing the shop foremen and erection department. Mr. Cooper was in the shops but twice, only once saw any of the finished bridge members and was never at the bridge site at all after erection started, and consequently did not see or know of much of this preliminary work, and was

not familiar with the processes by which the bridge members were constructed. But his inspectors and our inspectors, working independently as checks upon each other, did not use their usual discretion, but I understand reported every error however slight directly to Mr. Cooper for his information and approval. This was an extra precaution on account of the importance of the work. It probably caused Mr. Cooper, who never saw the matters in question, to magnify their importance and to believe an unusual number of errors had been made, which is not true. On the contrary very few errors were made and all were properly and fully corrected before shipment in the most workmanlike manner. No member left the shops that was not fully inspected and accepted by the representatives of the Quebec Bridge Company.

The erection of this bridge was an important undertaking and every precaution was taken to avoid unnecessary risks, and our whole organization was impressed with this idea. Every one who observed its progress regarded it as a remarkable instance of performance in accordance with a pre-arranged plan, as a masterpiece of erection. This has been fully described to you by others. When the compression chord members began to yield at several places one after another as we can now see, and the whole bridge was on the verge of collapse, as afterwards developed, our staff at the bridge site observed the signs, and acted promptly and efficiently. They calculated correctly the stresses on the several members, and decided that failure from such stresses was impossible. When reported to Mr. Cooper he foresaw no immediate danger, and the same was true at the office of the engineers at Phœnixville. After the event we have learned what we did not know, and could not have known, before. Mr. Cooper states he could have saved the bridge, that he now knows the weakness of the members that failed, and could have remedied them at the cost of $100, but he does not say how, nor did he tell Mr. McLure on August 29, when he called on him, nor did he tell any one else, when the information might have been acted upon. I believe from all the evidence that was available at the time, there was no possible way to save the bridge, and the impending catastrophe could not have been foreseen or averted.

I believe that no engineer is able to state positively the cause of the failure or would wish to undertake to strengthen the compression members now built for the north side until after a satisfactory number of built up compression members of corresponding design of the largest possible section had been tested to destruction, but I think it is now possible to foresee that after such tests have been made the members already built for the north side can be increased in section, and made perfectly safe for use at a comparatively small cost, and that new members can be made for the south side to correspond exactly. We shall be glad to put our testing machine at the disposal of the Commission and to make when desired a series of tests upon it for this purpose, up to a cross-section of about eighty square inches. In respect to the sections of the compression members as built up for the Quebec bridge, I wish to say that it was not in the interest of the Phœnix Bridge Company to restrict the area or weight of these, as has been intimated, but that in a commercial way it was largely to its interest to increase the sections and the size and weight of the bracing, and from that point of view we should have been glad to have increased the weight. Our contract being not for a lump sum, but by the pound, any increase of metal would have been to our advantage. It was simply imperative, from the point of view of good engineering, and in accordance with the fundamental requirements of the contract and specifications, not to make the weight or the price of the bridge any more than was demanded by the best practice. The consulting engineer, in the interest of his clients, was supreme in this respect. We proceeded with the contract unrestricted by any consideration of the financial strength of the company which employed us. No restriction of that kind was ever heard of by us—we were always promptly paid, and we never economized in any respect by reason of any such consideration. It can be seen now that some increase of weight was requisite, especially in certain compression members, and prior to the shipment of any of these members we called this matter to the attention of Mr. Cooper, but Mr. Cooper

would not allow any increase whatever in these members, and decided they fully met the requirements.

There was no undue haste. Progress in the drawing room was always retarded while the engineers checked and rechecked their calculations. Progress in the shops was always retarded while the drawings were being examined and approved, and re-checked to provide for every possible condition of loading during erection and after; and progress in the field was always subject to delays by the engineers on the bridge, who controlled the operations of the erectors, and saw to the proper level and alignment. Due expedition was essential from many points of view, but it was never permitted at the expense of safety or good workmanship.

Every opportunity and facility has been given you while in Phœnixville to find out for yourselves, and from the officers, engineers and employees of the company, that this company was fully qualified and able to construct this great bridge in the most workmanlike manner; to observe the extensive preparations which were made in advance in additions to plant, in special tools, and in the increased number and capacity of cranes; to ascertain that in actual construction the best quality of material was used, the best workmanship performed in the shops, and the greatest care taken in transportation. You have been given access to all our books and papers. The same facilities were previously extended to you at the bridge site, to ascertain our method and work in erection. I believe that, with the bridge members at Quebec designed and manufactured in accordance with the approved drawings, the work of erection was scientifically and properly conducted with appliances best suited to the purpose, and in a manner that was superior to anything ever previously attempted or performed. In all respects nothing was left undone that might have been done. I do not go into strictly engineering questions, leaving that to the engineers, nor into the question of what Mr. Cooper calls 'the defects and deficiencies which we now recognize in the compression members,' or whether chord 9 west truss failed first, as he says, because of deficiencies which he has since recognized, or how the bridge might have been saved. I disagree, however, with Mr. Cooper on all these points, and leave it to our engineers to fully explain the facts. I wish to say, however, that Mr. Cooper told me personally when I called upon him the Saturday following the collapse of the bridge, that he had no idea at the time there was any immediate danger, nor could he account for the actual failure.

I was well acquainted and in touch with the principal men we employed in erection, and with those representing the other interests at the bridge site, and know they were all well qualified for the several positions they filled, and superior men could not have been engaged to perform their duties. The cause of the failure cannot be found due to any departure from the specifications in design, material or workmanship, or lack of good judgment in the field. No engineer under the circumstances will accept the idea of a local defect to account for it. The profession is bound to look beyond that—in the employment of the unusually high stresses prescribed for compression members, beyond all precedent and, as it now appears, beyond the existing technical knowledge of their effect.

Mr. Cooper was appointed consulting engineer to the Quebec Bridge Company on May 6, 1900. He stated to the Commission he found nothing could be done in the way of changing the original specifications except with the authority of the Deputy Minister of the Department of Railways and Canals, and after considerable correspondence and discussion and a personal visit to Ottawa, he received on August 23, 1903, a copy of an order in council dated August 15, giving him the authority to make modifications from time to time in the specifications and the proposed loadings, provided the efficiency of the structure be fully maintained up to that originally defined in the original specifications attached to our contract.

He stated that this order in council gave him absolute authority to amend the specifications, and to order such alterations in the construction plans as seemed best in his judgment, that he discussed these alterations with the designing engineer of the Phœnix Bridge Company, but not for the purpose of getting at their wishes but the

benefit of the views of Mr. Szlapka. This expression of his absolute and final authority coincided with our understanding of it in our dealings with him under the contract. He made modifications in the unit stresses to be employed upon the various members which very much increased them beyond any precedent, and by so doing placed the whole design in a field outside the benefit of experience. Such high stresses had never before been used, and in using them he acted with the authority of the Quebec Bridge Company and the Dominion of Canada vested in him. The fall of the bridge is to be laid directly to the change in the unit stresses as made by Mr. Cooper.

I, Frank P. Norris, of the borough of Phœnixville, in the state of Pennsylvania, one of the United States of America, manager of the Phœnix Iron Works, make oath and say :

1. That I attended before the Board of Royal Commissioners appointed under the Great Seal of Canada for the purposes of inquiring into the causes of the collapse of the Quebec bridge, on several days during the months of October and November, 1907, in the borough of Phœnixville, in the state of Pennsylvania aforesaid.

2. That the attached twelve pages, numbered 876 to 887, both inclusive, contain my evidence in this matter. The answers to the questions are true statements to the best of my knowledge and belief.

Sworn before me in the city of Philadelphia, in the state of Pennsylvania, this 20th day of November, 1907.

Mr. NORRIS' testimony.

Q. What is your official position and how long have you occupied this position ?—A. Manager of the Phœnix Iron Works. Was appointed to this position in February, 1900, and was assistant superintendent of the works from May 1, 1896, until appointed manager.

Q. Have you any official connection with the Phœnix Bridge Company ?—A. No.

Q. What are your duties?—A. My duties are to manage the works of this company.

Q. Who is your immediate superior ?—A. Mr. William H. Reeves, general superintendent.

Q. Who are your subordinates in the carrying out of the work—give name of each with their respective duties and describe your organization?—A. My subordinates in the carrying out of the work are the department superintendents, as follows :—

Steel plant, N. E. Maccallum; rolling mills, E. G. Edgerton; bridge shops, R. W. Wright; templet shop, William Adams; pattern shop, Archibald Hoyle; machine shop, J. A. Murphy; eyebar plant, John Eagle; iron foundry, Joseph Challingsworth; steel foundry, W. C. Miller; beam and column shop, A. M. Setzler; testing, D. Gainor; general yard foreman, Albert Brehm.

Q. What was the date you were first officially advised to prepare for the construction of the Quebec bridge and who so advised you ?—A. In the spring of 1900 I was advised by Mr. William H. Reeves, general superintendent, that we were likely to receive instructions very soon to proceed with the Quebec bridge and that it was imporant that we look carefully into the question of the manufacture of the eye-bars for top chords and diagonal tension members, and at the same time stated that no bars must be used in the structure over 2 inches in thickness as he was satisfied from past experience that bars over 2 inches in thickness were not as efficient as those of this thickness or less.

Q. Prior to June 19, 1903, what work had you done in the shops in anticipation of having to build the Quebec bridge, and under whose authority was this done ?—A. The work done in shops prior to June, 1903 in anticipation of having the Quebec bridge to build was as follows, and was authorized by Mr. William H. Reeves, general superintendent :—

It was thought by some that we could not forge bars of such large dimensions, namely, 15 x 2 inches with eyes of proper width, to suit the different sizes of pins that would be necessary to use. We had frequent discussions as to how we would make these large eye-bars for the Quebec bridge. It was thought by some that we would have to cut them out of plates. Owing to the immense size of the bars it would have been next to impossible to get plates large enough, some of the bars requiring eyes 35½ inches in diameter, and the bars measuring 85 feet in length, which would have required a plate 36 x 2 inches x 85 feet 6 inches, weighing 20,948 lbs., which no mill in the world could roll. I then made up an estimate showing the comparative cost of upsetting and forging these eyebars from a 15 x 2 inches and of cutting them from a solid plate. This estimate was made up August 28, 1900, and satisfied us that cutting bars out of plates was out of the question and that forged bars must be used.

After much thought I formed the opinion that by making certain changes to our eye-bar upsetting machine we could upset and forge these 15-inch bars and obtain much better results than by cutting them out of large plates. To show that this theory was correct we made the changes necessary to the upsetter, made dies for hammer and all necessary appliances for forging 15-inch bars, and on October 6, 8 and 9, 1900, we forged ten 15-inch x 2-inch bars and tested two bars, one on October 12, and the other on October 13, test report herewith attached. This experiment cost in the neighbourhood of $1,000, and proved that we could make the bars and thus avoid delay in design of the bridge.

We were expecting to receive instructions any day to proceed with the bridge and we were thoroughly aware of the fact that before the fabrication of the different members was begun in the shop, owing to the immense size and weight, we should have to erect numerous large travelling cranes and secure a large number of new machines to do the shearing, straightening, milling, boring, &c., as tools for ordinary work were nowhere nearly large enough to take care of work of the magnitude of the Quebec bridge. Owing to the size and length of these sections it was necessary to make certain additions to our main bridge shop and strengthen the columns that supported the crane runway girders, and also replace the old runway girders with much stronger ones in order to carry the heavy loads. We did this work in the fall of 1902, as we realized it would take considerable time, and decided to make these improvements at once rather than to take chances of delaying the work.

The above changes to crane runways and additions to shop cost us between $28,000 and $30,000.

Q. After the date of the contract between the Phœnix Bridge Company and the Quebec Bridge Company, June 19, 1903, what special preparations were made in the shops for the manufacture of the bridge?—A. On June 19, 1903, the formal contract for the Quebec bridge was signed, and I was instructed to proceed at once to obtain whatever machinery and tools were needed to make the best job possible, regardless of their cost, and these instructions were carried out to the letter. Our total cost for extensions to plant, machinery, tools, cranes, &c., necessary to build the Quebec bridge was between $225,000 and $250,000.

Q. At what date was the manufacture of the steel commenced? At what date was the first working drawing given you; when was the shop work commenced and upon what member?—A. Manufacture of steel was commenced June 14, 1904, for the tower shells C. O.'s 604 and 605. The first working drawing was received at shops on June 1, 1904, and was for strut T. S. 3, between tower shells (the orders for the metal having been sent to 'mills' several days previous to sending drawings to shops). Shops started to punch the metal for this strut June 24, 1904.

Q. At what date was material ordered for lower chords and at what date was work on them begun in the shop?—A. Material was ordered for No. 1 chords C. O.'s 606, south anchor arm, July 19, 1904, and shops started to punch the metal for them August 5, 1904.

Q. Will you please state from your personal knowledge the main facts in the course of manufacture as they concern you, and any comments you have to make

upon them?—A. Every department superintendent, as well as the workmen in the steel plant, rolling mills, bridge shop—and in fact, all employees of the works were instructed to take the utmost care in preparing and handling the material for this bridge, as well as the punching, assembling, reaming, drilling, milling, boring, planing, &c. The engineers furnished the shops with drawings showing just how all the large members were to be loaded on the cars for transportation to Quebec, and numerous special appliances were employed for this purpose. All these instructions were followed with the greatest care.

During the months of May and June, 1904, we made a full-sized model of a panel point of the anchor arm to let our shop men see the size of the members we had to build, and to further impress upon them the magnitude of the work and the great importance of building the work just right, and also that they could familiarize themselves with details and avoid the possible chances of mistakes in the shops. This model cost between $600 and $800 to build, and can be seen on the second floor of the bridge company's office.

All the shapes for this bridge were rolled in our works; the plates were furnished by the Central Iron and Steel Company and the pin material by the Bethlehem Steel Company, and inspected at the different mills by the inspectors appointed by the consulting engineer.

After the chords, posts, &c., were riveted up complete, they were laid out by the shop superintendent personally—in his absence by his assistant—before being placed in the rotary planers (for facing) and boring mills, and were checked up after each cut to make doubly sure the work was being done correctly. In many cases, if not always, these layouts were checked by either Mr. Edwards or Mr. Meeser, as an extra precaution, and were always checked by the Phœnix Bridge Company's inspector. We threw every safeguard possible around this work to avoid errors, and notwithstanding, a few minor errors did creep in, but none of a serious character. They were remedied to the entire satisfaction of the consulting engineer's representative. The chief inspector of the Phœnix Bridge Company kept a complete record of all variations from the drawings, even to the chipping of a rivet. This record can be seen by the Commissioners if desired.

When the question of inspection of the Quebec bridge in the shops was first brought up I made a strong plea that the best shop inspectors that were obtainable should be placed on the work. The consulting engineer, as I remember, stated distinctly that he would not have the inspection done by an inspecting firm, as he wanted men of his own selection who would have no duties but to be right on this work all the time. This met with my ideas exactly, except that the consulting engineer stated that he wanted young men just out of college who, being without any practical experience, could be trained according to his own ideas. This I, as well as other officials of the company, protested against strongly, as we wanted experienced men from the start. The result was that Mr. Edwards, a man with some twenty years' experience, was appointed chief shop inspector, and later Mr. Meeser, another experienced inspector, was appointed to assist him. Mr. McLure also spent considerable time assisting Mr. Edwards with the shop inspection before taking up his duties as inspector of erection. Mr. McLure also spent the winter months assisting with shop inspection.

The inspection on this work was the most thorough of any I have ever witnessed.

Everybody appreciated the magnitude of the work, and the great importance of making it to conform to the drawings.

With a view of keeping the shop work right up to the highest standard, I called Mr. Edwards in the office at different times, and requested him to accept nothing but the very best work, and at the same time cautioned both him and Mr. Meeser to always check the measurements with their own private tape, and to the best of my knowledge and belief they did this.

There was never any friction between the Quebec Bridge Company's inspectors and our men; all were working to the same end, namely, to make a bridge second to none.

Realizing the absolute importance that every part of this bridge must be right, and to impress all the shop men with this fact, I placed notices around the shops, before the actual fabrication of the work commenced, calling their attention to the fact that we were about to start work on what was to be the largest bridge in the world, and requested every man to do his best.

We put the very best mechanics in the shop on this work. The boring was all done by expert machinists.

I want to say most emphatically, and the actual work will bear out my statements, that we all appreciated the great magnitude of the work and the utmost importance of doing it just right. The way the work went together in the field proved it was right. Everybody who has seen the work does not hesitate to say that it is the very best.

Any tests that were asked for by the consulting engineer were always willingly and promptly made and with the greatest care. Together with Messrs. Edwards and Meeser, the inspectors, and Messrs. Deans and Szlapka, I spent many hours in the testing room witnessing the making of the eyebar tests. We placed our toolmakers at the disposal of the inspectors to check their readings of the Vernier callipers. These tests cost a considerable sum.

All the members in this bridge, including the eyebars, were measured by steel tapes, standardized by a tape in the possession of Mr. Edwards, the Quebec Bridge Company's chief inspector, to which were attached spring balances or scales, and 12 pounds pressure was put on the tape for every measurement made. This insured uniformity of measurements throughout the whole job. The pins for this bridge were forged in the armour plate forges of the Bethlehem Steel Company, at an extra cost of $20 per ton over and above what we could have purchased ordinary hammer forged pins for, and which would have filled the requirements of the specifications. We all appreciated the great importance of getting the best pin material obtainable, as they had an enormous load to carry, and after many weeks of careful consideration of this particular part of the structure we were instructed to order these pins at this large additional cost, by Mr. David Reeves, president, who from the very beginning said that we must use the best of everything in this bridge, regardless of cost. These instructions have been rigidly lived up to.

In October, 1904, we spliced chords No. 1 and No. 2 of the anchor arm together under the shipping crane in our yard and requested the consulting engineer to come to Phœnixville to see how nicely the work went together. After waiting nearly a week he finally came over and was evidently much pleased, as we never heard anything to the contrary. The last week in November of the same year we spliced chords No. 4 and No. 5 of the anchor arm together—(these are the first two chords that are cambered).

After putting on all the splice plates we had our transit man square and level them up with the instruments, then compare them with the drawings, and found them as near to the drawings as it was possible for human hands to make them.

We did not complete the splicing of the above chords until late on a Saturday evening and on the following Sunday morning Messrs. Edwards, Szlapka, Scheidl, Wright (shop superintendent) and myself, together with a number of others, were there to see whether the work came together as it should, and as stated above, the work was accurate. The next day, and for the next couple of weeks, we made several attempts to get the consulting engineer to come to Phœnixville to see these chords, but he positively refused to come. We were very much surprised at this as we were told many times by Messrs. Deans and Szlapka that these cambered chords were probably the most important sections in the bridge and so much depended on having them just right so as to keep the bridge in perfect alignment.

When the first shoe was completed in the shops we assembled both bottom and top pedestals, shoe No. 11 chord, main post foot, floor beam connections, and all the various plates that connected the shoe for brace connections. (We have photographs of the above assembled together.)

Again we requested the consulting engineer to come to Phœnixville to see for himself how well each part fitted to the other and the excellent work we were doing, but he refused absolutely.

The consulting engineer in his testimony speaks of the company being slow in making the special eyebar tests. This was due to the fact that it took considerable time to get the plain bars from the plate mill. After they reached our works it required considerable time to forge, anneal, straighten and bore the bars, and the testing, owing to the numerous measurements that had to be made, was a slow process and required many days.

Mr. Hoare, chief engineer of the Quebec Bridge Company, was at the works numerous times during the past four years and always seemed well satisfied with the class of work we were doing for him. At the same time he always kept impressing on us, as well as on the inspectors, the great importance of making everything just right.

Before the main traveller was completely designed for erecting this bridge we made tests of different kinds of antifriction metals to make sure of getting the very best for the bearings of this traveller, on account of its great weight and the heavy sections it would have to lift. The shackles were made by the best makers in the country and when they arrived here we tested several of then in the testing machine. The results were not satisfactory and we refused to accept them and forged them here from solid steel billets. The same care was taken with the false work and travellers, both large and small, as with the bridge proper, and the materials and workmanship were of the very best. Many tests were made of the materials that went into the false-work and travellers, same as were made for the big bridge. Great care was taken to have all sections carefully painted before being shipped or put in storage, and the material in storage has been carefully looked after.

I gave the Quebec bridge material my most careful attention through its various stages in mills and shops, and realizing the great responsibility that naturally was placed upon me as the works' manager, I gave up everything in the way of vacations, and have been in the works practically every day since we commenced work on the bridge in 1903, except for five days in October, 1905, that I spent going to and at the bridge site in Canada.

I, JOHN STERLING DEANS, of the town of Phœnixville, in the state of Pennsylvania, one of the United States of America, engineer, make oath and say:—

1. That I attended before the Board of Royal Commissioners appointed under the Great Seal of Canada for the purpose of inquiring into the causes of the collapse of the Quebec bridge, on several days during the months of October and November, 1907, in the town of Phœnixville and the city of Philadelphia, in the state of Pennsylvania aforesaid.

2. That the attached 24 pages, numbered 889 to 912, both inclusive, contain my present evidence in this matter. The answers to the questions are true statements to the best of my knowledge and belief.

3. That the letters and letter-books produced before the Commission, from which exhibits 74 to 83, both inclusive, purport to be copied, are the correspondence received and sent by the Phœnix Bridge Company and its officers in the ordinary course of business, in relation to the Quebec bridge.

Sworn before me in the city of of Philadelphia, in the state of Pennsylvania, this day of November, 1907.

Mr. DEANS' testimony:

Q. From whom and at what date did you receive the cross-section of the River St. Lawrence at the bridge site and other data required for the preparation of the

first preliminary plan?—A. On June 16, 1897, Mr. E. A. Hoare wrote to the president of the Phœnix Bridge Company, asking if any engineer of the company expected to attend the annual convention of the American Society of Civil Engineers, which was to convene in Quebec on June 30; if so he asked that the engineer call to see him, in connection with a project for bridging the St. Lawrence river near Quebec. It was natural that Mr. Hoare should address the Phœnix Bridge Company in this connection, as about twenty years before, while he was chief engineer of the Quebec and Lake St. John Railway, the company had constructed bridges for his road. I attended the convention and met Mr. Hoare for the first time, and also met Mr. Audette, Mr. Boswell, Mr. Dobell and other directors and officers of the Quebec Bridge Company. Mr. Dobell entertained the entire convention at his home on the St. Lawrence near the bridge site, and during the trip by steamer explained to the engineers present the proposed site of the bridge and the steps the company were taking towards its construction. Mr. Cooper, afterwards consulting engineer of the Quebec Bridge Company, was in attendance at this convention, and learned of the enterprise at that time. Mr. Hoare said to me on the occasion of this visit to Quebec that if we were interested in the bridge project: 'I shall be glad to send you a profile of the crossing at the proposed site and other necessary general information so that you may, if you wish, be prepared to bid, if the project is carried out.' Shortly afterwards I received from Mr. Hoare the said profile and information.

Q. Please file copies of the outline plans prepared by the Phœnix Bridge Company dated November 30, 1897, and December 7, 1897, respectively?—A. I file copies of general outline plans prepared by the Phœnix Bridge Company dated November 30, 1897 (Exhibit 88) and December 7, 1897 (Exhibit 89) respectively.

Q. Please examine the official plan prepared by the Quebec Bridge Company, dated January 13, 1898, and subsequently filed with the government of Canada, and state if the truss outlines, as shown on it, are identical with those shown on the Phœnix Bridge Company's plans, dated December 7, 1897?—A. I have compared these plans and find that the truss outlines are identical.

Q. Please refer to your letter of November 8, 1897, to E. A. Hoare, and state whether or not the general features of the Quebec Bridge were determined by the Phœnix Bridge Company's engineers?—A. No, except as to the general outlines of trusses, and lengths of spans.

Q. Please state why, in advance of the submission of competitive tenders, the Phœnix Bridge Company allowed its plan for this bridge to become public property by being filed in the Department of Railways and Canals and thus becoming available for use of its competitors?—A. I do not remember that I knew that our preliminary studies of this work, as shown on plan dated December 7, 1897, were incorporated in a plan filed by the Quebec Bridge Company with the Department of Railways and Canals. Had the Quebec Bridge Company asked permission to use the plan I would not have objected. In any case I do not consider the fact of any special significance or as giving our competitors any advantage. At the time tenders were asked, about a year later, bidders had free scope in the matter of design, length of anchor arms, &c., and were asked to bid not only on cantilever span, but on suspension design. As a matter of fact our own tender did not agree exactly with the above preliminary study.

Q. Please refer to your letter of April 14, 1899, to E. A. Hoare and state if you did not understand that economy in design was to be of first importance in arriving at a final choice between competitive tenders?—A. I understood economy in design was of importance but not of first importance and not to be secured at the expense of any requirement of the specifications or of obtaining the most capable contractor for the work.

Q. Was the subsequent letting of various contracts to the Phœnix Bridge Company in pursuance of the understanding referred to in the letter of April 14, 1899?—A. No. Mr. Cooper reported favourably upon our plan and tender as submitted March 1, 1899, and the contract was awarded to us on this report of Mr. Cooper.

Q. Please refer to your letter of 19th of April, 1899, to E. A. Hoare, and state your understanding of the instructions that had been given to Theodore Cooper when that engineer undertook the examination of the competitive designs and tenders?—A. I have read my letter to Mr. Hoare of April 19, 1899, I understood that Mr. Cooper was to recommend for acceptance the lowest and best tender and plan which met every requirement of the specifications.

Q. Did consultations take place between Mr. Cooper and the engineers of the Phœnix Bridge Company relative to the determination to increase the main span and to the determination of amendments to the specifications, and had these conclusions the approval of the engineers of the Phœnix Bridge Company?—A. At Mr. Cooper's request Mr. Szlapka had interviews with him at which Mr. Cooper stated it was proposed to increase the span and amend the specifications. The Phœnix Bridge Company had nothing to do with the determination of these questions. We were not asked to approve the proposed action.

Q. Did the Phœnix Bridge Company fully concur in and approve the action of the Quebec Bridge Company, and of the government of Canada in practically making Mr. Cooper's approval of the plans for the bridge final for all parties?—A. We neither concurred or dissented. Were not asked to do so. We were bound by the action of the Quebec Bridge Company and the government of Canada in making Mr. Cooper's approval of the plans final for all parties.

Q. Did Mr. Cooper suggest to you his inability to continue as consulting engineer, and if so when was this, what reasons did he assign and how did you view his suggestion and with what result?—A. About two or three years ago Mr. Cooper spoke to me about the possibility of his being unable, owing to illness, to continue his duties as consulting engineer and suggested the name of Mr. C. C. Schneider as his successor, should this contingency arise. I told Mr. Cooper that we would consider it unfortunate if a change in authority in the midst of construction occurred and that I hoped and believed he would soon be better and remain through the entire operation. As a matter of fact Mr. Cooper did improve promptly and as far as I could see was soon in his usual state of health and continued his duties in the same manner as previously.

Q. Did the Phœnix Bridge Company at any time suggest the employment of Mr. Cooper, Mr. Edwards, and Mr. McLure in their several capacities?—A. No suggestion of the employment of any of them was made by this company. About the time the necessity of appointing a consulting engineer arrived, Mr. Hoare said the Quebec Bridge Company was considering the names of four or five engineers, among them the name of Mr. Cooper, and asked me as to their ability and experience, and I said I considered Mr. Cooper the best fitted for the work. We received an application from Mr. McLure for a position. I did not know him, but knowing that Mr. Cooper desired to secure the services of a young graduate of some experience in bridge work, I turned the application over to him.

Q. Do you consider that ample time was given to the study and preparation of the plans? In this connection we understand that the actual weight of the suspended span over-ran that assumed in the calculations for the anchor and cantilever arms by fully 25 per cent?—A. Yes. Ample time was given. The actual weight of the suspended span did over-run that assumed in the original calculations. The estimated weight was necessarily approximate.

Q. At what date was first plan approved by the Department of Railways and Canals received by you and what was this plan?—A. The first plan of the main structure, approved by the Department of Railways and Canals, was received by us October 28, 1903; it was the plan of the floor beam drawing B anchor arm.

Q. Prior to October, 1904, was your office work confined to the anchor arm?—A. No. Prior to October, 1904, our office force was at work on stress sheets of the entire bridge and on the shop details of the approach span, anchorages and anchor arm.

Q. At what date were the final arrangements made under the contract of June 19,

1903, which permitted you to proceed freely with your work?—A. February 22, 1904. The final arrangements were concluded on this date. We had in the meantime been working on our plans and details of the structure and making provisions for properly and promptly constructing the work.

Q. When you sent the stress sheet of the anchor arm for approval to the Department of Railways and Canals, had you completed your stress sheets for the suspended span and the cantilever arm, and had you designed the traveller?—A. The anchor arm stress sheet was approved by Mr. Cooper, June, 1904, and by the Department of Railways and Canals October 11. The traveller was designed April, 1904.

Q. When did you sent the stress sheets of the suspended span and cantilever arm for approval and had you then designed the traveller?—A. Stress sheets for the suspended span was sent February 19, 1904, and for the cantilever arm, May, 1905; the traveller was designed in April 1904.

Q. After completing the stress sheets of the suspended span, and of the cantilever arm, and the design of the traveller, did you find that modifications were necessary in the stress sheet of the anchor arm, what were they and did they tend to increase or decrease the stresses?—A. Yes. It was found necessary to make modifications in the stress sheet of anchor arm, due to increase in weight of suspended span and cantilever arm, but not to the traveller.

Q. Were the members of the anchor arm designed from the stress sheet of October, 1904, which sheet reached the Department of Railways and Canals at the same time as the plans of the details of the bottom chords?—A. Yes.

Q. When the plans for the bottom chords were approved had any of the chords already been built, and were they in accordance with the plans as approved?—A. None of the chords were built before Mr. Cooper approved the plans.

Q. Was any work done or material ordered prior to receipt of approved plans from the Department of Railways and Canals, and if so give details.—A. Yes. Work was done in many instances including anchor arm chords and other members upon receipt of plans approved by Mr. Cooper and before the plans were actually approved by the government, as Mr. Cooper's approval was final as far as we were concerned. No changes were ever made by the government on any plans approved by Mr. Cooper.

Q. The contract between the Phœnix Bridge Company and the Quebec Bridge Company provided for payment at prices per pound of material erected complete. Was there any limit at all placed upon your company as to the amount of money the bridge should not exceed in cost, or was any sum mentioned by you that it would not exceed ?—A. No.

Q. What financial considerations governed you in the design of the structure ?—A. We were not governed by any financial consideration in connection with the design of the structure.

Q. Did the consulting engineer at any time urge upon you the necessity of economy, beyond the point where you considered the best efficiency could be obtained ?—A. He effected economy in cost by changing the specifications, and these changes lowered the efficiency of the bridge. In details not expressly covered by the specifications he also exercised economy. He endeavored to reach an economical design, and we did not think he carried this so far as to lead us to question the safety of the structure.

Q. Did any one else ?—A. No.

Q. Have you and your staff acted harmoniously with Mr. Cooper throughout this work ?—A. Yes.

Q. Did the changes in unit stresses meet with your approval ?—A. The changes in unit stresses were made by Mr. Cooper and were not submitted to us for our approval. Mr. Cooper merely talked the matter over with Mr. Szlapka as a brother engineer, but not however for the purpose of getting the wishes of the Phœnix Bridge Company. He then reached a decision of which we were notified and upon which we acted.

Q. Did these changes follow previous experience, or did they take the work out

of the field of past experience in bridge construction and detailing and in what respect ?—A. The changes in unit stresses for compression members carried them out of the field of past experience in bridge construction and detailing and did not follow usual practice.

Q. Do you consider, in view of this, that enough time and study were devoted to the preparation of designs?—A. Yes. We took all the time considered necessary for the study and preparation of plans and I believe Mr. Cooper's office also took all the time that they considered necessary.

Q. To your personal knowledge, was Mr. Cooper's examination and criticism of plans aggressive and did he insist on discussion of all matters in which questions arose ?—A. Yes. The examination of details and plans by Mr. Cooper's office, I believe, was conscientiously and carefully done. Discussions often arose but Mr. Cooper's decision always prevailed.

Q. Were all plans to your knowledge approved by the consulting engineer ?—A. Yes.

Q. In any instance were plans sent to the Phœnix Iron Company before the approval of the consulting engineer was obtained and was any fabrication commenced prior to such approval ?—A. In a few instances and late in the work, plans were sent to the shops for preliminary work before the actual approval by the consulting engineer; so that we would be prepared to carry on the work promptly. This was only done in the case of plans of which the design and detail had already been established and approved by the consulting engineer. We took the risk of possible alterations by him. But in no instance was a single member of the bridge actually completed which was not in accordance with the final approved plans.

Q. Was the design of details of the lower chord particularly discussed with Mr. Cooper, and was his opinion specifically obtained on the latticing and other details and, if so, please state fully what took place ?—A. Yes. I had no interview with Mr. Cooper on this subject, but I instructed our designing engineer particularly to submit the question of size of latticing of chords to Mr. Cooper. Mr. Szlapka later reported to me that he had an interview with Mr. Cooper on this point, and Mr. Cooper advised him that the lattice angles were correct as shown on approved plans. Mr. Szlapka will give you the details of his interview with Mr. Cooper on this point.

Q. We understand that the Phœnix Bridge Company maintained an independent inspection of the shop work done by the Phœnix Iron Company. Please file a copy of the record of the errors detected by your inspector ?—A. An independent inspection was maintained and I herewith submit the daily record. Exhibit No. 90. Every error, however small, is noted in that book, and all these errors were corrected before the work left the shop.

Q. Were all errors reported satisfactorily corrected by the Phœnix Iron Company ?—A. Yes.

Q. What precautions were taken to insure the safety of the bridge members in handling and transportation ? What measurements were made at the bridge site to detect distortion or injuries occurring to members in transit ?—A. Special precautions were taken to insure the safety of the bridge members during handling in transportation. We consulted with the superintendent of the Motive Power of the Pennsylvania R. R. Company and devised with his representative special schemes of loading. All large and heavy pieces were the subject of special consideration with the transportation companies. All members were carefully inspected as to distortion and injury during transit, after the members arrived at bridge site and before they were erected in place. I cannot say just what measurements were made in the course of this inspection. This inspection was by the representatives of both the Quebec Bridge and Railway Company and the Phœnix Bridge Company.

Q. Please file a full list of all members injured in handling or in transit with a statement of what subsequent action was taken in each case.—A. Only one member was injured in transit, being the shell frame south anchorage. The repairs to this member were explained in detail in the evidence of Mr. A. B. Milliken. One member

was injured in handling at south storage yard, being chord 9 L anchor arm, repairs of which have been fully covered in evidence. One member was dropped in handling in the shops, slightly injuring it and one or two other smaller members. Thorough repairs were made, all as shown in detail in shop inspector's report. These members were thoroughly repaired under the direction and to the satisfaction of the inspectors.

Q. Please file a complete list of 'field corrections' reported from the bridge site. —A. We file herewith complete list of field corrections reported from the bridge site and noted during the erection of the structure. (Exhibit No. 91)—most of these refer to false work and erection apparatus.

Q. Please file a statement compiled from your weekly records showing the weight removed from and added to the cantilever arm and suspended span during 1907.—A. We file the statement compiled from weekly records showing weight removed and added to cantilever arm during 1907. (Exhibit No. 92.)

Q. Please give a statement with dates complete showing fully Mr. Birks' experience and the nature of the work upon which he had been employed?—A. A statement of Mr. Birks' experience in no sense conveys a proper estimate of his ability which was unusual for a man of his years. He was specially fitted by character and temperament for the work entrusted to him. His experience was as follows:—

On March 22, 1902, we received a letter from Geo. F. Swain, prof. C. E. Mass. Institute of Technology, Boston, suggesting the name of A. H. Birks to us as a desirable man for our engineering department. He wrote as follows:—'I also have an exceedingly good man who graduated in architectural engineering and has been taking a post-graduate course with me. His name is A. H. Birks. Birks is a man of exceptional ability in this line and having taken all my work in structures is as well up in bridge work as building work. He has also had some experience, having worked one summer with a bridge company, and one year in an architect's office, I believe. He is an exceptional man.'

We gave Mr. Birks a position and he started to work in our draughting department and worked there for about six months. We soon found he had traits of character and ability that would well fit him for erection work, and he was transferred to the erection department on October 7, 1902.

Between October 7, 1902, and November 8, 1902, he was in the field on erection of plate girder spans N. & W. bridge, Circleville, O.

December 1, 1902, to June 15, 1903, on Central Railroad of New Jersey bridges, Wheelers Locks, Parryville and Glen Onoco (plate girder structures) and Lehigh river bridge, Parryville (through riveted spans).

June 18, 1903, to August 13, 1903, Southern Railway bridges, Caswell, Tenn., Mascot, Tenn., Knoxville, Tenn., Alexandria, N.C., Wolf Creek, Tenn., Jefferson City (all plate girder spans) and Tennessee river bridge, Straw Plains, Tenn., 105 feet (deck plate structure).

February 11, 1904, and during the month he was inspector on Southern Railway bridges—James river bridge, Lynchburg, Buffalo river bridge, Rappahannock river bridge. (All through truss bridges.)

July 24, 1904, to August 3, 1904, at Deepwater, French Broad river, Hot Springs, N.C., 264 feet (through pin span) during the erection of the trusses.

In March, 1905—Jacksonville, Fla., examining sites of two Atlantic Coast Line Railroad draw bridges, securing necessary information for preparing erection plans.

February, 1906, New London, Conn., arranging method of erecting Jordans Cove bridge.

During the intervals not covered by above, Mr. Birks was engaged on erection plans and details in the office at Phœnixville.

When the Quebec erection was taken up early in 1904, Mr. Birks assisted in all the preliminary studies and continued on this work until the entire plan was fully developed and settled upon. Many of the features of this erection scheme which worked out so successfully in practice were due to Mr. Birks' peculiar ability in this line. His familiarity with every detail of the erection scheme and the behaviour of

the trusses during erection, his thorough technical training, his absolute reliability, decided us to appoint him resident engineer of erection, and he was sent to Quebec in September, 1904. He was on the work during the working season from that time until the date of the disaster, with the exception of the period during the erection of the main traveller, when Mr. C. W. Hudson was resident engineer.

Mr. Birks was fearless and was able to climb over the entire structure. He had a lovable character and that about him which instantly demanded respect and confidence. He could have his orders carried out readily without friction. It would be difficult to find a man combining the many traits of mind and character which so eminently fitted him for the position of resident engineer of erection.

Q. Please file a detailed statement of all the long span bridges that have been built by the Phœnix Bridge Company since 1890 ?—A. The Phœnixville Bridge Works have constructed since 1865 about six hundred and ten thousand tons of bridge work. They are the pioneers in bridge construction in the United States. Among the larger works constructed by the company we mention the following :—

Pecos Viaduct, Texas, Southern Pacific Railway, 2,080 feet long, 326 feet high. (1889).

Ohio River Bridge, Cincinnati, O., C. & O. Ry. One and one-half miles long, containing 550 feet through pin span, the longest and heaviest truss constructed. (1888).

Harlem river draw, New York City, 303 feet through riveted. Turntable 60 feet diameter, largest in the world. (1896).

Red Rock cantilever, Santa Fé Railway, 660 feet central span. (1890.)

Mississippi river bridge, Rock Island, Ill., for United States government. A double deck structure 1,850 feet long. (1896).

Cambridge bridge, Boston, Mass., 11 plate arch spans, weight 16,000,000 lbs. (1904).

Omaha draw, 520 feet through pin. (1893).

Sioux City bridge, Nebraska, two 470 feet draw spans; two 500 feet through spans, 4,000 tons. (1896).

Manhattan bridge, New York, 1,470 feet central span, 725 feet side spans, 34,000 tons (not including cables). (1906-7.)

Q. Why were Mr. Cooper's suggestions of August 9, 1907, for the repair of the splices at 7 L and 8 L cantilever arm, not adopted and promptly executed ?—A. After the lower chords, including the details of shop and field splices, were approved by the consulting engineer, the engineers of the Phœnix Bridge Company and the Erection Department carefully considered the action of the field splices during connection of trusses and the camber movements of splices while members were receiving their full dead load. A special camber blocking was designed and placed on false work under each panel point. This blocking was easily adjusted and free to move longitudinally. Special consideration was given to the bolting before the riveting of splices. Full instructions were prepared in advance of erection and incorporated in a blue print book of instructions to the field force. The bolting was checked in person by the resident engineer and regular reports sent to Phœnixville. The action of the joints was noted and reported on printed forms as erection proceeded, by the resident engineer in charge of field instrument work. The action of joints was also noted specially by the designing engineer and assistant engineer in charge of details during several visits to the bridge site. All of this was in addition to the regular erection supervision by the general foreman and his assistants. The splices were under the closest scrutiny at all times and they acted as expected in closing to complete contact. No report was received at Phœnixville advising us of anything wrong in connection with any splice until August 8, 1907, in a letter from Mr. Birks dated Bridge Site, August 6, 1907. In this letter he advised us that one of the inside ribs at bottom of splice chord 7 L—8 L cantilever arm was bent out of line and enclosed a sketch of a diaphragm to be riveted between the ribs to hold them in their position. This proposed diaphragm was sent to Mr. Cooper by Mr. McLure on same

date as it was sent to us, but he did not approve it. See telegram from him, August 8, 1907. (Exhibit No. 79-F & 73-J.) Mr. Cooper never gave us any instructions concerning the matter. His letter of August 9, simply deals with ideas and you will notice by his letter of August 13, that he desired before acting to get further information from his resident engineer Mr. McLure. His letter of August 21st indicates that he had not yet reached a decision and the matter was still in this unsettled state when the accident occurred. There were no joints in the anchor arm where similar bend in rib was noticed; they all lined up true and satisfactory.

Q. Were chords 9L, anchor arm, and 9R and 8R, cantilever arm, in perfect condition when they left Phœnixville?—A. Yes.

Q. Were requests and suggestions made by Mr. Cooper with regard to tests and to matters of erection always promptly considered and, when acted upon, was it with all possible promptness, giving specific instances?—A. Yes, as instances: Special tests of eyebars in connection with deformation of eyes; water gauge levels for use at bridge site; investigation of top section of main post by Mr. Scheidl.

Q. What is your opinion concerning the movements of the bridge when falling? —A. The position of the wreckage indicates to my mind that a compression member, a lower chord in anchor arm down stream truss, failed first and, immediately following, the compression member directly opposite failed. The failure of these two compression members permitted the anchor arm to move two panels toward the river. The lower chord of cantilever arm being relieved of support forced the two shoes towards shore and broke off a lower section of main post. The down stream, chord anchor arm failing first permitted the truss to drop vertically as well as horizontally and had a tendency to pull the higher parts of the superstructure down stream. The pinnacles at the top of main posts are pointed in this direction.

Q. Please explain the references in Mr. Birks' letter of August 29, 1907, with regard to the telephone conversation about stopping the work of erection?—A. On August 29, 1907, we first learned from the letter of August 27 from Mr. Yenser that buckles were noticed in webs of lower chord 9L of anchor arm. Consultation then took place at Phœnixville between the engineers, shop officials and inspectors, and it was determined that chord could not be bending from any excessive stress, as it was carrying only three-quarters of the work load for which it was designed and approved. We then called Mr. Yenser and Mr. Birks on the 'phone and advised them of our conclusion. During this conversation on the 'phone they notified us that a portion of the bends had been in the webs for a long time. That since writing on August 27 they had carefully watched and repeatedly examined the chords and found there was no further movement, and that they had proceeded with the erection without waiting for advice from us. As this action agreed with our own conclusion we told them we thought they had acted wisely in not stopping the erection. Mr. Birks' letter refers to this 'phone conversation. While a chord with bent webs, even though bends are slight, is not capable of performing its functions as well as a perfectly straight member, the bends in chord 9L noted on August 27 and of which we learned on August 29 were not such as to shake absolute confidence of years which all had in the entire structure. If the consulting engineer then believed there was imminent danger and that all work should be stopped immediately it was not necessary to inquire whether Mr. A. B. Milliken was at site or not. Mr. Hoare had sent Mr. McLure to Mr. Cooper to report on the bends in chord 9L and to receive his advice. Mr. Hoare was in Quebec and any message to him would have stopped the work instantly, as was done on a previous occasion by direction of Mr. Cooper. The testimony of others shows that Mr. Cooper on August 29, no doubt, had no thought of imminent danger. We all now see, what no one dreamed of before, that the compression chords were beyond any scheme of protection on August 29 and were failing under less than half the load for which they were designed and approved and were considered capable of sustaining without failure. While it is difficult it is essential, in order to reach an accurate judgment, to keep in view the frame of mind every one was in before August

29 regarding this structure and its strength and the respect and confidence all had in the engineers responsible for its design and detail.

Q. Was the bridge in all particulars designed by the engineers of the Phœnix Bridge Company and were these designs fully approved by the Quebec Bridge Company through their consulting engineer, Mr. Cooper?—A. The bridge was designed in its general features by the engineers of the Phœnix Bridge Company. The details of the bridge were worked out in connection with the consulting engineer, to agree with the modified specifications which he had prepared, and all plans and details were approved by the consulting engineer, Mr. Cooper.

Q. Please file the reports showing the condition of the joints in November, 1906, and also a similar report to August, 29, 1907. At what date was the joint 8-9 L anchor arm riveted?—A. Reports herewith show the condition of joints November, 1906, and also a similar report of August 29th, 1907. (Exhibit No. 93.) Joint 8-9 L anchor arm was riveted, June 1907.

Q. The contract for the main spans was signed June 18th, 1903, and called for the completion of the work by December 31, 1906. Was the time allowed, in your judgment, sufficient for the satisfactory carrying out of the work? Did Mr. Cooper express any opinion to you concerning this?—A. The time for completion in our contract of June, 1903, was given as December 31, 1906, and was fixed by the Quebec Bridge Co. We believe this time was too short and would not agree to be bound by it, and on the date the contract was executed, letters, which have been submitted to you, passed between the two companies extending the time to December 31, 1908. Mr. Cooper subsequently expressed his opinion in this connection saying four or possibly five years would be required for the construction of the bridge, this long time being required because of the short working season for erection and not because of other construction demands. As a matter of fact the Phœnix Bridge Co. was unable to start on the work as early as had been expected because of the delay in the completion of the south approach to the bridge, and hence notwithstanding due diligence on its part the work could not have been completed for some time after December 31st, 1908.

Q. Please state the circumstances that called for the letter to you from Mr. E. A. Hoare, dated October 20th, 1906?—A. Mr. Hoare's letter of October 20th, 1906, was called forth by correspondence I had with Mr. Milliken in connection with the demand which Mr. McLure had made to him to stop certain work on falsework of south anchor arm, after Mr. Milliken had received instructions from me over the 'phone to proceed with this work at once. It was work which demanded prompt attention and was not of such an important character as to call for action on the part of the consulting engineer; and while it was a change from our original printed instructions, it was only such a change as might be looked for in work of this character. Mr. McLure was fully informed of all our erection methods, etc. In this particular instance there was no opportunity to advise Mr. McLure in advance. Mr. McLure or any other representative of the Quebec Bridge Co. could have had the work stopped by communicating with his superiors. The correspondence which you have will give you further details.

Q. Is there any known system of bridge erection that could eliminate or modify the camber system adopted by you in the erection of the Quebec Bridge, and was the system adopted by you after careful study and calculation, the proper mechanical method to adopt?—A. I know of no system of erection of a stiff frame which can be carried out without some form of a camber system. It is a mechanical necessity. This system has been used with success from the beginning of bridge construction, and in the Quebec Bridge was worked out in greater detail than ever before. A special camber blocking at each panel point enabled us to keep the work in absolute control. As the dead load was applied and changes in anchor frame were taking place, the action of all joints was watched and reported and we found that the truss was behaving exactly as expected and it continued to do so up to the time when all joints had a full and complete bearing.

Q. Is a statement that the Phœnix Bridge Company had promised both the

Quebec Bridge Company and the Dominion government to complete the bridge in 1908 and was therefore pressing the work with all speed consistent with safety, a correct statement of facts?—A. The Phœnix Bridge Co. when asked at the time of signing the contract and later, assured the Quebec Bridge Co. and the government that it would use every effort to complete the bridge within the contract period, but no promise was made to do so.

Q. Please state what technical knowledge of permanent value to the engineering profession has been obtained in connection with the construction of the Quebec Bridge?—A. It is too soon to give in any proper manner the 'technical knowledge of permanent value to the engineering profession' which will grow out of the construction of the Quebec Bridge and the disaster of August 29.

Q. We understand that the bridge was struck by lightning on more than one occasion. Will you please say what effects were observed due to lightning and do you connect them in any way with subsequent events?—A. During the construction of the work lightning struck the wooden derrick at top of main traveler, destroying the mast but doing no other damage. Lightning also struck the end of the traveler which was raising falsework on north side, damaging the end of traveler only. These two occurrences had no connection with subsequent events.

Q. Did you interest yourself in any way at any time, and when, in any attempt to negotiate or dispose of securities of the Quebec Bridge Company, and with what result?—A. At their request we introduced the officers of the Quebec Bridge Company to bankers in this country at the time the Quebec Bridge Company desired to dispose of their securities. Nothing definite came out of these negotiations.

Q. What was the reason for the failure of these negotiations, and what reasons did the parties give for not taking up the project?—A. As I remember, the experts of the bankers reported at that time that they did not find a sufficient possible traffic in the near future to pay interest on the bonds. Then all expressed their belief in the ultimate value of the property but the returns were too remote for bankers in this country.

Q. Did you fully consider the Quebec Bridge Company's project at this time from a business standpoint and did you approve it after you had made your investigation?—A. At the earliest date I had personal confidence in the Quebec Bridge Company's project and strongly approved of it to the officers and directors of my company.

Q. Was the executive work in the negotiating and carrying out of the contract done by you on the part of the Phœnix Bridge Company?—A. The executive work in connection with the negotiations and carrying out of the contract was done by me.

Q. In your negotiations with the Quebec Bridge Company did you find that all matters were conducted on a purely business basis?—A. In all my negotiations with the Quebec Bridge Company all matters were conducted on a purely straight business basis.

Q. Did you receive any favours over your competitors?—A. No.

I, Charles Scheidl, of the town of Phœnixville, in the state of Pennsylvania, one of the United States of America, engineer, make oath and say :—

1. That I attended before the Board of Royal Commissioners appointed under the Great Seal of Canada for the purpose of inquiring into the causes of the collapse of the Quebec Bridge, on several days during the months of October and November, 1907, in the town of Phœnixville, in the state of Pennsylvania aforesaid.

2. That the attached twenty pages, numbered 914 to 933, both inclusive, contain

my evidence in this matter. The answers to the questions are true statements to the best of my knowledge and belief.

Sworn before me in the city of Philadelphia, in the state of Pennsylvania, this day of November, 1907.

Mr. SCHEIDL'S testimony :

I was born on July 11, 1860, in Neuburg, on the Danube. In 1866 I went to the public school and in 1871 I entered the Royal Bavarian Gewerschule in Neuburg on the Danube, graduating in 1875. For a few months I was in the employ of the Royal Bavarian Railway as draftsman on a new railway line. In 1875 I entered the Royal Bavarian Industrieschule in Augsburg and graduated in 1878. I was next in the employ of Civil Engineer Heilman who had the largest construction business in Munich. I was there for two years and had the advantage of a very considerable practical experience. I also had charge of a large construction work there for one year. I joined the Bavarian army in 1880, serving for one year, after which I went back to my former employer in Munich. In 1882 I re-entered the army and remained for two months only, I having passed the examination for a reserve officer. In 1882 I went back to my former employer in Munich and had charge of construction work again. In the fall of 1882 I was employed as draftsman by the New York firm of Schwarzman, my work there being in connection with building work. In 1883 I was employed by Civil Engineer Bergner of Philadelphia as draftsman in connection with the building of some manufacturing establishments. On May 25, 1883, I entered the employ of Clark, Reeves & Company, now the Phœnix Bridge Company as draftsman. I was given charge of the drafting work in 1889 and since that time I have had charge of almost every kind of work in the bridge line; for instance, a part of the Pecos Viaduct, Fairmount Avenue bridge in Philadelphia and a large number of different kinds of spans for various railway companies. I had charge of two 500 feet spans at Sioux City, of the Rock Island bridge—a government bridge—and of part of a second Rock Island bridge for a railway company. At present I am assistant engineer of the Phœnix Bridge Company in charge particularly of detail designing. I have occupied that position since 1889.

With reference to the work of designing the Quebec Bridge, Mr. Scheidl made the following statement :

I.—Preliminary office work after approximate stress sheets of bridge had been determined.

The first step in connection with the detail work for this structure was to remove to a private office and go over the outlines of the bridge at the same time looking over the general stress sheets which had been furnished. The first thought was: How will the suspended span be connected to cantilever, how supported by it and is it to swing free at one or both ends? Next my thoughts were given to details of shoes for main posts and then follow the anchorages. In building this structure one naturally had to find first the manufacturing limits of existing bridge plants regarding :

First, tension members. It had been decided to use 15-inch eyebars as best suited for this bridge and it was found that a 12-inch round pin was the limit at that time on account of the large size of such eyebar heads. Yet, it was known that the top chord of anchor and cantilever arms must be composed of a broad chain of eyebars of dimensions hardly ever used before. The packing of top chord eyebars had therefore to be so arranged that a 12-inch round pin would satisfy all the requirements of the specifications, while for built up members any size of pin could be used.

Second, compression members. The building of compression members seemed at first to involve no difficulty whatever, but as soon as some of the connections had

been studied it was found that more than one pin at a panel point must be used for any successful detail and for safe erection and the question of links presented itself at once . Through the attachment of links for eye-bar connections these compression members assumed such dimensions that the question of transportation became a most important consideration. The carrying loads and clearances of the different railway companies transporting material to Quebec had to be studied before any large compression member could be detailed.

Returning to the detailing of suspended span, one end had been arranged fixed while the other end moved on a nest of rollers. This roller arrangement caused a bulky detail at end of cantilever besides which the end posts of suspended span could not be braced properly near the floor line. Moreover, great difficulty was experienced from the eccentric loading in a longitudinal direction caused by the movements principally due to temperature, but also due to deflection of trusses, which movement might have been further increased by some slight error in not building main piers 1,800 feet C to C. This movement amounted to about 2 feet. Finally the erection of such a roller end would have involved additional difficulties and it was found that the use of swinging end posts would give the best results.

The next question was how to provide for the transfer of wind stresses from suspended span to cantilever arm. Such a transfer was made at first in the four bottom chord ends of suspended span, but this scheme had to be abandoned because of the difficulty of making these arrangements in both stresses work simultaneously. Finally, a design with only one transfer of wind stresses per span end was decided upon as it gave safe and determinate results.

All the different panel points of the suspended span were now detailed, and exact pin packings made, etc. This suspended span, though larger than ordinary long spans, presented no special difficulty. The erection problem could at this time be gone over only in a general way.

The details for the suspended span were those generally used. The details at intersections of top of hangers and top of sub-posts were first tried with one pin, but the connections made the one pin very long and the connected members had undesirable, long, weak jaws, while with the introduction of links the hanger and sub-verticals could be connected in a most satisfactory and substantial manner to the transverse bracing, giving greater stiffness. Besides the difficulties of erection were reduced, as otherwise the traveller would have had a much greater overhang and this would not only have increased the weight of the traveller but also the weight of the structure. It was the intention at this stage to try some toggle arrangements for adjusting suspended span halves during erection.

The next study was that of the arrangement of the top chord packing for cantilever and anchor arms. Links fast to posts for diagonal eyebars were deemed necessary. The question of using two pins for top chord connections at main posts of cantilever also arose and it was proposed to use only one pin at these apices. The details of the principal panel connections were drawn out next. The links for connection at bottom end of diagonal eyebars were first designed fast to bottom chord as being more desirable and smaller in size, but this scheme had to be given up as the connections of floor beams to posts and bottom chords became weaker, while links fast to posts gave a splendid connection between floor beams and posts. This obviated the necessity of having end stiffners on floor beams shipped loose as depths of floor beams exceeded shipping limits. After all these apices had been sketched out and the packing plans for trusses completed the main shoes and main posts were gone into. Extraordinary dimensions were required for the pedestals under the main shoes to properly distribute such an enormous weight over the masonry. The original idea was to build each tier of pedestals in one piece, but shipping limits forbade this and special milling machines had to be constructed. The shoe had been so designed that all loads passed through its pin, but the scheme of letting the main post bear directly on the pedestals while shear from bottom chords only passed through shoe pin was considered too. Special attention had been given to transferring all wind loads collecting near

shoe into masonry. The detail at top of main post was at first tried with one pin but two pins were found necessary. The main post had been so designed that the placing of its ribs gave the best resistance to bending of that part of post where transverse bracing had to be omitted for passage of trains and wagons, while ribs of posts near top and bottom had to be placed in a longitudinal direction.

The details for connection of top laterals, top transverse strut and top chord should be specially mentioned as many devices were sketched out before a selection was made.

The anchorages had already been built with a liberal allowance at that time for any increase of uplift and also the two 214 foot approach spans had been built. These items require no special notice here. All this preliminary work had been done during January, February and March, 1902, by myself and I was always in charge of all detail work of this bridge.

II.—Preliminary Work.

After the receipt of the revised specifications, preliminary work, showing practically final results, commenced in July, 1903.

The first step was to determine normal lengths of all bridge members. As trusses had not a single horizontal member all inclined members were designated by ordinates and co-ordinates expressed exact in feet and inches. The elevation of any panel point could quickly be checked without knowing the length of any inclined member. To get lengths of inclined members three different methods were applied. One method was squaring sides, adding and taking square root. This was done independently by three men. Another method was the use of logarithmic tables and a last method was by means of tables of squares, thus eliminating any error that might be hidden in a book of squares. During the further progress of the work the lengths were checked at least ten times. Next in order, preliminary drawings of all plate and trussed floor beams and of all stringers were made and sent for approval. The execution of these floor beams and stringers was most elaborate with reference to the spacing of rivets in webs and covers, taking care of end shear, net sections, &c. Then, details showing type of transverse bracing were made for approval; also details showing very clearly main shoes, pedestals, connecting chords and bracing of same.

The arrangement of eyebars for the anchor arm required considerable time and study as the bending moments on pins had not to exceed the allowed values of a 12-inch round pin. After some packings had been arranged and the problem of manufacture studied carefully the final decision was to have no eyebars thinner than 1¼ inches nor thicker than 2 1/16. To avoid additional stresses on eyebars the skew in regard to C. line of trusses had not to exceed 4 inches in 50 feet. If the skew could not be kept within that limit on account of clearances for bridge, eyebars were bored skew to eliminate additional stresses in eyebars and the method of marking such eyebars was most distinct and precise so as to make sure that any such bars would not be placed the wrong way in the bridge. The sides of these eyebars were marked before being removed from the boring machine and the heads were painted 'inside' and 'outside' with different colours. It is needless to say that the calculations for packing all top chord eyebars was a most tedious and time swallowing operation.

In all cases the desire was to avoid difficult calculations by placing eyebars so that moments could be reduced to zero as often as possible. All eyebars were so grouped and ribs of chords were so divided as to get 2, 3, 4 or 5 (or even half sets) equal sets; in other words all ribs at connections were packed alike and, therefore, stressed alike. In all top chords the stresses coming from diagonals were counterbalanced by eyebars in chords and placed so that this transfer was practically direct while the rest of the chord eyebars, getting their stress from former panel points, were side-lined.

The details for anchorages were worked out next. The method of transferring windshear at end of anchor arm to masonry had been made through checks between end floor beams and top strut of windbent. The uplift caused from wind had been

taken care of by means of long foundation bolts. This wind uplift was finally ordered to be taken care of by the main anchor bars themselves and only the horizontal transverse shear was resisted by foundation bolts. The transferring of windstress from end of anchor arm to top strut of windbent was finally accomplished by means of a tenon girder which had a roller bearing against top strut of windbent and could move in any direction whether the movement was caused by temperature or by change in the loading of the bridge.

The lengths of all stringers were determined then by calculating the length of chords for all the different ways of loading and finding therefrom the lengths of stringers according to their elevation between chords. These stringer lengths were fixed so as to give the least bending in floor beam. The result was that every other panel had an expansion joint. At expansion joints the railway stringers only were fast to the floor beam on one side, while all other stringers were slightly loose so that bending of floor beam could not take place in the short distance between chords and nearest stringer.

At this stage the preliminary detail of all anchor arm panel points was started commencing with the end bottom chord. All these plans were made in a most elaborate manner, all stresses, pin bearings, number of rivets, calculations for each, etc., were clearly given on each drawing. All ribs of chords were so arranged as to divide each truss connection into two, three, four or five equal ribs, so that each got its proper share from diagonals; in other words 'all roundabout' connections were avoided to secure the simplest and most direct connection in all cases.

Though all main posts consisted of only two ribs, the ends had to be provided with four or more ribs for proper chord connection. At bottom of posts the floor beam shear was transferred to all four ribs in the most direct manner.

Sub-posts and hangers were built of only two ribs throughout, but where they were connected, for instance, to a four rib detail, each rib got quarter of the stress in vertical and horizontal direction. Wherever additional ribs and posts were placed all such connections fully provided for shear, chord stresses, etc. The bearing values on pins had been made one and a half times the allowed stress, but this was later changed to 1¼ times the allowed stress. Shear on pins was made ⅘ times the allowed stress. The net section through pin hole was made first 1¼ times and later 1:3 times the net section of member, while the net section back of pin holes was made ⅘ of that through pin hole. In determining net sections through pin holes not only rivets directly opposite pin were considered, but the placing of any rivets in such links was most carefully followed throughout. The net sections of all riveted tension members were found by assuming the rupture to take place through any diagonal line of rivet holes where the net section does not exceed by 30 per cent the net section of the transverse line. All panel points of anchor arm had been sketched out in the most studious way. Most points were shown giving several ways of making the connections until a final one had been selected. As these sheets showed not only every detail but all the calculation throughout, it was an easy matter for any draughtsman to make final shop drawings therefrom in a most intelligent manner. Neither pains nor time were spared in any of these preliminary details for the anchor and cantilever arms and suspended span. Every detail had been clearly demonstrated in every conceivable manner before shop drawings were made; in fact, many of the draughtsmen became disgusted with the never ending trials to improve these details. When the details for anchor arm were completed and those for the cantilever arm partially completed the weights of all details were calculated by the computing department and final anchor arm stress sheets furnished. This was the beginning of the shop drawing period. Only the anchor towers had been shop detailed in the meantime, as sketched out sometime previously.

III.—Shop Work.

Before commencing the shop work on the anchor arm a clear understanding with the erection department had to be arrived at as to where the field splices had to be

finally placed. As an overhead traveller, running on falsework and straddling both anchor arm trusses was provided for, the erection problem of the anchor arm was simplified as far as the office work was concerned. The work of getting out shop drawings for the large traveller and steel false work had been assigned to two other assistant engineers.

For the cantilever arm and suspended span complete plans were got out showing the location of splices, the number of each piece in the order in which it was to be erected, temporary rods and struts and support of large traveller. A special drawing had been made for each position of the large or small traveller, and these drawings formed a binding contract between the draughting office and erection department. Before any shop drawing of the larger pieces could be made sketches giving the extreme dimensions, weight, &c., had to be made for the different railroad companies. This took considerable time as these companies had not only to determine if these large pieces could be shipped over their own lines but if they could be shipped the whole distance from shop to bridge site. Such sketches were, in many cases, quite extensive drawings requiring much time in the office for preparation and often showing special beams, struts, castings, pins, &c., to rig up cars, without reference at all to the work in this line usually done by the shipping department. It was necessary to provide for the proper distribution of loads between sets of wheels and to lay out railroad curves so as to make sure that links on posts, &c., placed in special well cars would not touch the wheels or be otherwise injured on sharp curves.

The normal condition of truss shape had been fixed for a certain position of live load giving practically the maximum uplift and all cambers were derived therefrom. All angles and abutting splices were figured for this position so as to be sure that under full loading any extra initial stress would equal zero.

Pinholes for 10½-inch°, 12-inch° and 14-inch°, pins were bored $\frac{3}{64}$-inch larger than size of pin.

Pinholes for 24-inch°, pins were bored $\frac{1}{16}$-inch larger than size of pin.

Pinholes for 7 $\frac{11}{16}$-inch, pins were bored $\frac{1}{32}$-inch larger than size of pin.

Pinholes 2 $\frac{7}{16}$-inch, pins were bored $\frac{1}{60}$-inch larger than size of pin.

In determining the length of eye-bars the first correction was for camber, the second for permanent set, the third correction was on account of play in pinholes and in eyebars placed skew, the fourth correction was for skew. The permanent set in eyebars was determined by a series of tests. The correction for permanent set in anchor eye-bars was $\frac{3}{64}$-inch per head, while for the rest of the bridge $\frac{1}{32}$-inch only was used as the eye-bars were finally made of a higher ultimate steel. The correction in built lengths was $\frac{1}{32}$-inch for each eye.

All posts with link attachments involved additional work in determining the lengths as the exact position of pin in pinhole for chord connection had to be found first and correction in all directions was made therefrom. In all cases the distances C. to C. of pins represented the lengths of members and not the distances C. to C. of pinholes. In posts with links the eye connecting to chords had to fulfill all the requirements of a regular tension link to suit the resultant stresses of chords.

All rivets were determined by these values.

For shop rivets 1:5 times allowed stress for bearing value.
" 0:75 times allowed stress for shear.
For field rivets 1:1 times the allowed stress of bearing value.
" 0:55 times the allowed stress of shear.

To get the proper elevation of bottom chord for erection purposes the deformation of the anchor arm was found according to Williott's method. It was assumed at first that the main post was plumb and that the whole anchor truss rotated around the pin of the main shoe until the end bottom chord pin could be connected to the top of anchor eyebars. For this purpose a rotation diagram was constructed which gave the location of every apex after rotating the struss. For the purpose of jacking up the trusses special jacking blocks were provided for two 500 ton jacks per panel point

To get deformation diagram in the most exact manner all the vertical members had to be corrected again for compression, as they carry heavy top loads during erection, while for all diagonals and chords a position for pins in pinholes had been assumed which seemed most probable.

As the bottom chord is 4½ feet deep the abutting splice ends could not fit exactly as they were designed to fit perfectly under full load. Therefore, these differences had to be calculated and ½ of the amount considered as an increase in chord length. These openings were intentionally made only half the amount that had been figured. In like manner the deformation of trusses was found for any position of the traveller on the cantilever arm or suspended span; also, for final position under dead load, dead load and live load, and according to temperature. The result was that the horizontal movement due to temperature was the greatest, the changes from dead load or live load seemed small and the vertical movements did not affect the detailing to any appreciable extent.

For erection of cantilevers the tops of main posts were provided with two pins giving an improved and safer method of erection.

For adjusting suspended span halves during erection, two 1,250 ton jacks were provided at each end of bottom chord. For the same purpose a toggle arrangement, worked by two 500-ton jacks was provided at each end top chord of cantilever. The bottom panels of suspended span half to be erected last were built of eye-bars, while all other chords had to be of 'built section.' By means of this arrangement the bottom chord could be erected completely although the end distance was too little, as truss halves were jacked up and no fine adjustment would have been required. The last diagonal of suspended span had a special pin connection for quick connection although the joint was to be a riveted one finally. The details of the suspended span were still further improved by making most of the joints riveted connections. Of course, diagonal eye-bars were connected by pins. This method simplified the erection. As soon as two members had been erected final connection could be made and they were self-sustaining.

In getting out the shop drawings for this bridge only a small force of expert draughtsmen were selected at first and the number was gradually increased. It required three years to complete the office work. It was thought best not to subdivide the work among the different assistant engineers but to give one man full charge from beginning to end. All drawings were prepared under his direction and whenever a drawing was completed it was examined by him carefully in regard to lengths, sizes, strength of all details, notes for shops, inspectors and transportation. It was only then that these drawings were forwarded in duplicate to the consulting engineer for his approval. If approved seven additioinal prints of complete, checked drawings were sent to the consulting engineer for his approval and six copies were returned by him to the Bridge Company, who sent five copies to the chief engineer of the Quebec Bridge Company. The Phœnix Bridge Company received one print back approved by the Dominion government. The drawings were made in such a manner that all information necessary for the proper execution of the work in the shop was given, as clearances, notes explaining any peculiar detail or calling attention to all important dimensions regarding width, depth, &c., and information for the sole use of inspectors.

In building some of the posts with many heavy top links, where a large number of plates form one link, these links were bound to vary in thickness. The collars for pin packing were only ordered after each post was built and the clearances reported to the office. The second checking of finished drawings in regard to spacing rivets fitting to the other members, &c., had at first been done by the assistant engineer in charge, but this work was then assigned to other assistant engineers, thus relieving the one in charge of this burdensome work and giving him more time for the preparation of drawings.

All shop drawings were executed in a most elaborate manner. Most of the principal drawings are real masterpieces illustrating how shop drawings should be made.

The Phœnix Bridge Company can show these drawings with pride to any expert bridge draughtsman.

As the checking of drawings had to be done by different assistant engineers some doubt arose as to whether some errors might not occur as a result, but thus far the part of the bridge erected has proven that the checking has been done in a most excellent manner.

At no time during the progress of the office work were more than eighteen men working upon it at a time. If twice that number had been employed the result would have been the same. The rate of progress depended upon the rapidity with which the person in charge performed his work.

As said before, the preliminary details were made with all calculations and the best results were obtained in preparing the final details. Every draughtsman who was employed in the preparation of the drawings for this bridge will testify to the unusual care which was taken to bring this work to a successful conclusion. In comparing the details of this bridge with those of existing long spans with pin connections, one finds, for instance, at the intersection of diagonals with hangers and secondary posts, a large number of forked members with long thin jaws, packed on one pin, which certainly does not give the impression of good rigid connection. We have striven, in preparing the details for this bridge, to avoid members with long thin forks. Even a casual observer will notice their absence from this bridge, and it will also be evident to him that a stiffness in the connections has been secured through the application of links not obtained in similar pin bridges before.

I, Peter L. Szlapka, of the borough of Phœnixville, in the state of Pennsylvania, one of the United States of America, engineer, make oath and say:—

1. That I attended before the Board of Royal Commissioners appointed under the Great Seal of Canada for the purpose of inquiring into the causes of the collapse of the Quebec bridge, on several days during the months of October and November, 1907, in the borough of Phœnixville, in the state of Pennsylvania aforesaid.

2. That the attached thirty-six pages, numbered 934 to 969, both inclusive, contain my evidence in this matter. The answers to the questions are true statements to the best of my knowledge and belief.

Sworn before me in the city of Philadelphia, in the state of Pennsylvania this day of November, 1907.

Mr. Peter L. Szlapka's testimony:—

Q. What is your official position in the Phœnix Bridge Company?—A. My official position with the Phœnix Bridge Company is that of designing engineer.

Q. How long have you occupied this position?—A. For the last twenty-one (21) years.

Q. When did you enter the Phœnix Bridge Company's service and in what capacity? How much time during this period have you spent—in drawing office, in computing department, in the erection office and in field work?—A. I entered the Phœnix Bridge Company's office in 1880 as bridge draughtsman. I spent six years in the drawing room and twenty-one years in the designing department. I was not engaged in either the erection department or field work.

Q. In your present capacity are you the responsible designing engineer for the company?—A. Yes.

Q. Previous to entering the service of the Phœnix Bridge Company, will you please state generally what your experience in bridge work had been.—A. I took

seven years' classical course in a German college, and a four years' general engineering course in the Royal Polytechnic School in Hanover, Germany, and when entering the service of the Phœnix Bridge Company, I had the above thorough theoretical college training.

Q. During the period you have occupied your present position will you please state what large bridge structures you have designed which have been built by the Phœnix Bridge Company, giving dates and general dimensions?—A. The following are some of the largest structures designed by me, viz.:—

Ohio River Bridge, at Cincinnati, Ohio, consisting of two (2) 490 foot and one (1) 550 foot double track through spans, designed in 1888; the three spans weighing over 5,000 tons.

Ohio River Bridge at Louisville, Ky., consisting of three (3) 546 foot single track through spans, built in 1890; the three spans weighing 2,700 tons.

Tennessee River Bridge, at Decatur, Ala., one (1) 382 foot draw span, built in 1901, weighing 500 tons.

Tennessee River Bridge at South Pittsburgh, Tenn., built in 1906, weighing 650 tons, one (1) 436 foot single track through draw span.

Bridge over St. Lawrence River, at Cornwall, Ont., three (3) 365 foot single track through spans, built in 1897, weighing 1,500 tons.

Bridge over St. Lawrence River, at Cornwall, Ont., main span, 840 foot cantilever, built 1898, weighing 1,200 tons.

Q. Please state your office engineering organization in the course of designing, detailing and checking your bridge work?—A. The general design of the bridge was prepared in the designing department, under my personal supervision. The work was then handed to Mr. Scheidl, engineer in charge of the shop drawings—the main features of the design were explained and complete specifications as prepared by the consulting engineer were given to him for his guidance in designing the details of the bridge. After preparing the general preliminary details of the most important connections, Mr. Scheidl discussed same with me, and changes were made, if found necessary. These preliminary drawings were discussed with Mr. Cooper and changes made as directed by him. After these preliminary details were established to our complete satisfaction, an assistant engineer and a number of first-class draughtsmen (varying from five to fifteen) were assigned to Mr. Scheidl's charge, who prepared the final shop drawings, using the preliminary plans for their guide. The final shop drawings were only then considered as complete, after being changed as many as seven or eight times, when they were entirely satisfactory to us and when we believed they could not be improved. The general calculations were checked twice in the designing department and twice in the drawing room during the preparation of shop drawings.

Q. Did you design the Quebec bridge?—A. Speaking in a general way, yes. The bridge is of such a magnitude as to be beyond the ability and physical endurance of one man. The results achieved represent combined efforts on the part of all the departments of The Phœnix Bridge Company, under the direction of the consulting engineer, Theo. Cooper.

Q. Was the regular organization of your department made use of in connection with the designing, detailing and checking of the Quebec Bridge, or was there any special organization for this purpose? Please state your process in detail fully explaining all precautions taken to reach accurate results?—A. The regular organization of my department and of the drawing room were entirely capable of dealing with the problem. No addition was found necessary. The shop drawings were first checked by Mr. Scheidl, the engineer in charge, as to strength, general clearances, facility of erection and connections with other members. The assistant engineer, under immediate charge of Mr. Scheidl, checked the drawings as to their correctness for all connections and for shop work. At certain stages of the work, when the drawings were too far ahead of the checking, as many as six engineers and five of the best draughtsmen were used as additional help in checking. The few errors found during erection are the best evidence how carefully all the shop drawings were prepared and checked.

Q. We understand that your plan No. 1 of the Quebec Bridge dated November 30, 1897, (Exhibit No. 88) embodies information as to length of spans, cross section of river and height of bridge. From whom did you receive this information?—A. The information referring to the length of spans, cross section of river, and the clear height of bridge, was furnished by Mr. Hoare, chief engineer of the Quebec Bridge Company, on a plan which is in your possession.

Q. Please examine your plan No. 2, dated December 7, 1897, and compare it with the plan dated January 13, 1898, and signed by Messrs. Parent, Barthe and Hoare and say if these two plans are identical as to superstructure?—A. Our plan No. 2, dated December 7, 1897 (Exhibit No. 89) is identical as regards the superstructure, with the plan dated January 13, 1898, signed by Messrs. Parent, Barthe and Hoare.

Q. Is the plan of January 13, 1898, practically a copy of your plan of December 7, 1897?—A. Yes.

Q. Please file copy of plan No. 1 and plan No. 2, and also copy of the plan submitted with the tender to the Quebec Bridge Company in 1899 for 1,600-foot span?—A. I file copies of plan No. 1 (Exhibit No. 94) and plan No. 2 (Exhibit No. 95); also plan submitted with tender by the Phœnix Bridge Company in 1899 for the 1,600-foot span (Exhibit No. 96).

Q. Please file complete stress sheet and tables showing the unit stresses and net sections of all members, panel concentrations and estimated weight of structure divided between anchor arm, cantilever arm and suspended span corresponding with the design accompanying your tender?—A. I enclose complete stress diagrams for the design of the 1,600 foot span, being duplicates of plans submitted with the tender (Exhibit No. 97), also weights of the river crossing (Exhibit No. 98).

Q. Was this stress sheet worked out exactly in accordance with the specifications sent to your company by the Quebec Bridge Company?—A. In designing the 1,600-foot span the Quebec Bridge Company's specifications were followed in every particular except as regards wind pressure under 30 degrees to the horizontal, which requirement was disregarded as unnecessarily severe.

Q. Did the weights ascertained from your strain sheet agree with your assumed weights and, if not, will you please state in detail what process you use in arriving at your final stress sheet which was the basis of your tender of 1899?—A. The plans submitted with the tender being only of an approximate character, no recalculations were made based on the approximate weight ascertained from the first calculations.

Q. Was there any doubt in your mind at this time as to the existence of data sufficient to enable engineers of your experience to design this bridge especially in regard to large compression members?—A. No, I have no doubt on the subject, but as stated in the preceding answer, the first design was only approximate and the minor details were not considered at the time, except a few of the most important general points, which were given a careful study.

Q. Was this the largest structure that you had ever attempted to design?—A. Yes.

Q. In the course of the designing of this bridge, did you consult with engineers outside of the Phœnix Bridge Company, and, if so, with whom?—A. I did not consult with any outside engineers as to the design of the bridge, except with Mr. Theo. Cooper, consulting engineer.

Q. On April 22, 1900, you prepared two plans, one indicating the river span as 1,723 feet, and the other indicating it as 1,800 feet. Will you please say what caused you to make these plans?—A. About April, 1900, I received orders from Mr. John Sterling Deans, chief engineer of the Phœnix Bridge Company, to prepare a plan with a central span of 1,800 feet. Not understanding that the length must be exactly 1,800 feet, the panel lengths working out better for a slightly shorter span, I selected a central span of 1,723 feet, keeping the length between th[illegible] feet, as required. After I was informed that the central span [illegible] prepared another plan in harmony with these ins[illegible]

Q. Subsequently to April 22, 1900, you made several general plans of the Quebec Bridge, all of which show the river span at 1,800 feet. Was the change in span from 1,600 to 1,800 feet entirely feasible from an engineering point of view?—A. Yes.

Q. When the 1,800-foot span was decided upon what recalculation of the structure did you make and will you please file copies of your complete original stress sheets and tables for an 1,800-foot bridge and anchor arm showing unit stresses, net sections, load concentrations and erection stresses; also, please attach to these strain sheets a bill of weights and the data showing dead, live, wind and snow loads used in calculations. What were your reasons for adopting the lengths of spans?—A. During May and June, 1900, only the suspended span and the cantilever arms were recalculated for the new length of the central span according to Quebec Bridge Company's specifications. No table of weights was prepared at this time. As regards the lengths of the cantilever arms and the suspended span, the latter was made three-eighths of the main central span; the usual length of the suspended span varies from three-eighths to one-half of the central spans. I selected the lower limit in order to reduce the erection stresses at the connection of the suspended span with the cantilever arm. I also believe that this arrangement enhances the beauty of the design. The anchor arm was made 500 feet by order of the chief engineer of the Quebec Bridge Company, which length appeared to be desirable in order to avoid reversed stresses in the top and bottom chords, according to the different positions of the live load.

Q. Up to this time had there been any work done in the way of designing of details, or were the details merely roughly estimated?—A. The details were merely roughly estimated.

Q. Was the study of the design what you would call complete having regard to its unprecedented dimensions and also having regard to the fact that details had not fully considered?—A. A continuous study was given to the general design, while the details were perfected as the work progressed. The final design, I believe, cannot be improved upon.

Q. When did you begin the study of details for this structure?—A. Many of the details were roughly sketched out as early as 1897 and 1898.

Q. What progress had you made in the study of details between January, 1902, and June, 1903, and did you find in the course of this study that the weight of the details was very considerably over-running your previous estimate of weights?—A. All important general details were drawn out by Mr. Scheidl, during 1902, as a basis for further study and perfection. The details, at that time, not being final, their weights were not ascertained, in order to compare them with the rough weights of details assumed in the calculations.

Q. During this period Mr. Theodore Cooper was consulting engineer for the Quebec Bridge Company. Did you confer with Mr. Cooper during this period on questions of design, and if so, will you please explain fully?—A. The outline of the bridge was discussed with Mr. Cooper fully. The lengths of the cantilever arm and the suspended span were approved by him, while the length of the anchor arm was specified by the chief engineer of the Quebec Bridge Company governed by local conditions. The panel length, the arrangement of the web system and the depths of the trusses were discussed and approved. Mr. Cooper was at first of the opinion that trusses inclined from the vertical would be preferable, so that the effect of any settlement of the main piers would not be as readily perceived as in the case with vertical trusses, when one or both trusses might be out of vertical. This question was finally settled by Mr. Cooper in favour of vertical trusses in October, 1903. Another point raised by Mr. Cooper was the vertical end posts of the anchor arm. His attention was called to the fact that the vertical posts were preferable to inclined end posts, admitting of simpler details for end portals, and at the same time giving to the anchor arms the appearance of greater length than would be the case with the inclined end posts. This question was also settled by Mr. Cooper in favour of vertical end posts, October, 1903.

Q. In the final designs for the structure were you striving to design the best

bridge possible, or were you limited in any way as to the ultimate cost of the structure and, if so, to what extent?—A. In designing the structure, I followed closely Mr. Cooper's specifications, put forth every effort to obtain the best results, and to secure the best bridge possible irrespective of ultimate cost.

Q. Had you specific instructions on this point, and, if so, from whom and what were they?—A. I have never received any instructions to sacrifice any features of good design in order to keep the structure within any specified cost.

Q. When business arrangements were made between the two companies so as to justify you proceeding actively with the work in the designing office, what part of the structure did you commence your studies on?—A. The floor system was figured first (July 1, 1903), followed by calculations of the suspended span (November, 1903-February, 1904).

Q. Will you please file a copy of the strain sheet (giving the corresponding information asked for previously on the other strain sheets) which formed the basis of your detail design of the structure?—A. I inclose herewith calculations of the main span (Exhibit No. 98).

Q. Were the data available at this time in regard to the weights of the cantilever arm and the suspended span sufficiently accurate to enable you to correctly design the anchor arm in detail?—A. The weights of the cantilever arm and suspended span were then believed to be sufficiently accurate—and were so approved by Mr. Cooper—to enable me to correctly design the anchor arm. Subsequently, when the suspended span and cantilever arm were developed, it was found that the actual weights were somewhat in excess of those assumed for the calculation of the anchor arm.

Q. At this period we find that certain modifications in the specifications were suggested by Mr. Cooper. Were these modifications discussed between you and Mr. Cooper? What modifications in the Quebec Bridge Company's original specification did you suggest to Mr. Cooper and what provisions of the written specifications were set aside by Mr. Cooper's orders?—A. On May 13, 1903, the Phœnix Bridge Company received a letter from Mr. Cooper, stating that he was ready to see Mr. P. L. Szlapka to talk over specifications for the main bridge. I visited Mr. Cooper on May 14th, and received from him a full explanation of the loading and unit stresses to be used in proportioning the members of the main bridge. Mr. Cooper impressed upon me the importance of strictly following his specifications, but at the same time to be prepared to consider special important features with him irrespective of the requirements of his written specifications. In view of Mr. Cooper's proposition to use, for certain combinations of conditions, unit stresses as high as 24,000 lbs., or ⅔ of an average elastic limit of 32,000 lbs., I mentioned to Mr. Cooper the fact that a German professor (I do not recollect his name at present) proposed to use a fraction of the elastic limit for unit stresses for truss members after first allowing for irregularity of shop work, for imperfect erection, for flaws in material, &c.

A table showing extreme velocities of wind at various stations as reported by the United States government from 1883 to 1893, for his consideration in discussing the question of wind pressures, I presented to Mr. Cooper. I did not suggest any modifications in the Quebec Bridge Company's specifications. After learning from Mr. Cooper his exact wishes as to the loading and unit stresses, the calculations were begun on the floor system, followed by the 675 feet suspended span.

Q. Please file a copy of all modifications of the Quebec Bridge Comapny's specifications which were approved by Mr. Cooper and which were actually made use of and adhered to throughout the designing of the structure as to loading, unit stresses, quality of material and workmanship?—A. Copy of the Quebec Bridge Company's specifications (Exhibit No. 99), a copy of modifications thereof prepared by Mr. Cooper (Exhibit No. 100) and copy of Mr. Cooper's specifications for workmanship (Exhibit No. 101-102) are attached herewith. These three specifications, together with occasional verbal instructions, referred to in the preceding [illegible] complete set of rules to be followed in designing and in
bridge.

Q. Did you fully concur in all the amendments made in the specifications, having in mind that you were endeavouring to produce the best possible bridge?—A. The amendments made in the specifications by Mr. Cooper were not subject to my approval.

Q. Will you please state the exact condition of the work of designing, what detail plans had been completed and approved by Mr. Cooper up to October 1, 1904?—A. Stress sheet, suspended span, approved by Mr. Cooper, March, 1904.

Stress sheet, anchor arm, approved by Mr. Cooper, June, 1904.

General detail drawing, suspended span, approved by Mr. Cooper, May, 1904.

All typical drawings of top and bottom panel points were prepared and approved by Mr. Cooper, May, 1904.

Plate floor beams and stringers were approved, July, 1904.

Shop drawings of two end panels were approved, August, 1904.

Q. At this date had you completed the stress sheet for the cantilever arm or for the suspended span and had you designed the main traveler?—A. Stress sheet of suspended span completed February, 1904.

Stress sheet of cantilever arm completed December, 1904.

Main traveler designed April, 1904.

Q. At what date did you complete the stress sheet for the cantilever arm; at what date did you complete the stress sheet for the suspended span; at what date did you complete the design of the traveler?—A. See answer to preceding question.

Q. Previous to October, 1904, we understand that you had completed the design of the anchor arm and that many of the detail plans had been approved by Mr. Cooper. What was the exact condition of the design of the cantilever arm at this date, October 1, 1904?—A. The stresses in the cantilever arm were figured with the exception of the erection stresses.

Q. What was your practice in regard to issuing orders to the shop to proceed with work? Did you in each case await the approval of Mr. Cooper before commencing the construction of any piece of work?—A. As soon as shop drawings were completed in the drawing room, and approved by Mr. Cooper, they were placed in the shops; in some cases we did not await the approval of Mr. Cooper as has been correctly explained by Mr. Deans.

Q. Was any work of construction commenced or material ordered before Mr. Cooper's approval of the plan was obtained and, if so, state what was done or material ordered and why this course was followed?—A. In order to insure continuation of the work in the shops and in the field, lists of materials and shop drawings were placed in the shops, in some cases, before the approval of the plans by Mr. Cooper at the risk of the Phœnix Bridge Company, as has also been correctly explained by Mr. Deans.

Q. Was any work commenced in the shop or material ordered before the plans had been approved by the Department of Railways and Canals, and, if so, please give details and say why this course was followed?—A. For the same reason, materials were ordered and shop work commenced, in some cases, before the approval of plans by the Department of Railways and Canals.

Q. Did you consider the approval of the plans by the Department of Railways and Canals a condition precedent to the fabrication of the bridge?—A. No.

Q. Please state when the fabrication of each of the lower chord sections of the anchor arm was commenced?—A. Chords finished in the shops as follows:—

No. 1.—October 19–October 20, 1904.
No. 2.—October 24–October 27, 1904.
No. 3.—November 3–November 5, 1904.
No. 4.—November 12–November 14, 1904.
No. 5.—November 25–November 26, 1904.
No. 6.—December 3–December 6, 1904.
No. 7.—December 13–December 17, 1904.
No. 8.—December 24–December 31, 1904.

No. 9.—January 7–January 16, 1905.
No. 10.—January 18–January 19, 1905.
No. 11.—June 3–June 10, 1905.

Q. Did you consider that the unit stresses used in the designing of the anchor arm, as determined under the revised specifications adopted by Mr. Cooper, were up to the extreme limit of economy in design and safety to the structure?—A. Yes.

Q. In finally developing the stress sheet for the cantilever arm and the suspended span, did you find that the weights produced were in excess of those estimated in the design of the anchor arm?—A. Yes.

Q. Did these excess weights tend to increase the stresses in the anchor arm?—A. Yes.

Q. Was the detail design of anchor arm altered so as to meet these increased stresses?—A. No.

Q. Were the unit stresses in members of the anchor arm increased beyond the requirements of the specifications above referred to?—A. The weights of the suspended span, end of the cantilever arm, assumed in the first calculation of the stresses of the anchor arm, were smaller than the weights as finally obtained. Consequently, the stresses of the anchor arm, due to these increased weights, were increased, the anchor arm having been built in the meantime.

Q. Please file a stress sheet of the anchor arm indicating in detail any such changes in unit stresses?—A. Sheet attached (Exhibit 103).

Q. Did you consider that these increases in unit stresses were still within the limits of safety?—A. Yes.

Q. Why was not the whole scheme of the bridge fully considered in detail before shop work commenced?—A. This was not practically possible. General experience enabled us to proceed without occupying valuable time, and the time limit precluded any such arrangement. This followed the usual course of business in such cases.

Q. Having in view the unprecedented dimensions of this structure, was it the proper course to pursue, or did you pursue the ordinary course as followed previously in connection with bridge building?—A. The ordinary rule, which is imperative in all cases, irrespective of the unprecedented dimensions of this structure, was followed.

Q. Whose instructions did you follow in adopting the above course, and what were the instructions?—A. I received my instructions from Mr. William H. Reeves, general superintendent, and Mr. John Sterling Deans, chief engineer, of the Phœnix Bridge Company, viz.: to place with the shops any shop plans as soon as approved, and to generally arrange the office work so as to insure continuous working on the bridge, in the shops and in the field.

Q. Were your relations with Mr. Cooper of a perfectly cordial nature throughout the whole period of the designing and erecting of the Quebec bridge?—A. Yes.

Q. Did you freely consult him on all matters?—A. Yes.

Q. Was Mr. Cooper's criticism of plans and design such as you might expect from an engineer of his experience and ability?—A. Yes.

Q. Was Mr. Cooper aware of the exact conditions of design on October 1, 1904, at which period he had approved the design of a large portion of the anchor arm, and was he aware that strain sheets for the cantilever arm had not been made?—A. Yes.

Q. Did he approve your assumptions of weights for the designing of the anchor arm and, if so, we would like you to establish this fact?—A. Examining the stress sheets thoroughly, and finally approving same in every particular, Mr. Cooper certainly, by this very fact, approved every main feature given on our plans; therefore, also the assumed dead load.

Q. Did Mr. Cooper complain to you at any time of the growing weight of the structure and with what result?—A. No.

Q. Did he order recalculations to be made, or, to your knowled
them himself?—A. Mr. Cooper did not order any recalculati
that the weights assumed for calculations were exceede

as reported to him by his inspectors, he no doubt made some calculations, as he remarked to me on one occasion during 1906 that 'this fact did not amount to anything.'

Q. Did Mr. Cooper intimate to you at any time that there was a limit which the cost of this bridge should not exceed, or did he complain at any time on the grounds of increasing cost?—A. Never.

Q. What was Mr. Cooper's reason for complaining of the increasing weights?—A Mr. Cooper never complained to me of the increasing weights.

Q. From your knowledge of Mr. Cooper would you consider that he would associate himself with a work which was inferior in any respect without protesting upon points which he considered inferior or inefficient?—A. I would not suppose anything of this kind for a moment, recognizing in Mr. Cooper the highest type of an able and honest engineer.

Q. What changes in general design or detail did Mr. Cooper suggest and did these changes enhance the value of the structure or detract from its value?—A. Mr. Cooper, amongst others, made the following suggestions:—

1st. Arrange anchorage of wind bent on anchor piers so that anchor bolts resist wind shear only, while the upward pull is transmitted to the anchor pier by the anchor bars only.—Adopted.

2nd. Change friction (due to lateral wind pressure and change of temperature) between end floor beam of anchor arm and top strut of wind bent from sliding to rolling friction.—Adopted.

3rd. Arrange expansion of floor system so that no undue bending is produced in the floor beams.—Adopted.

4th. Arrange expansion between suspended span and cantilever arm, at both ends, instead of at one end as proposed by the Phœnix Bridge Company.—Adopted, but not considered an improvement by me.

5th. Arrange packing of eye-bars in top chord of anchor arms, as per Mr. Cooper's two sketches.—Not adopted. Found entirely faulty by the engineering department. The Phœnix Bridge Company's packing adopted with very small modifications suggested by Mr. Cooper.

6th. Provide wooden traction arrangement between suspended span and cantilever arms, as shown on Mr. Cooper's sketch.—Not adopted, as not being in harmony with the high standard of the rest of the details of the bridge. Its design is still open. Mr. Cooper urged the adoption of this wooden arrangement as it could easily be made by a track-walker and attended to by him in case of repairs. Not wishing to criticise Mr. Cooper's scheme myself, I remarked that it might be criticised by the profession; to this Mr. Cooper answered 'there is nobody competent to criticise us.'

7th. Change lateral bracing in floor system, as per Mr. Cooper's letter.—Not adopted, as inferior to the Phœnix Bridge Company's design.

Q. Were you in any way hurried or rushed in the preparation of the design or did you consider at the time that you had ample time and opportunity for making all necessary studies in order to make the design perfect?—A. We were pressed in our office work, but we never sacrificed the perfection of the plans to the requirements of the shops or the field. I did consider that we had ample time and opportunity for making all necessary studies.

Q. From your knowledge can you say that Mr. Cooper critically examined all the plans submitted to him? We would like to know from you your candid opinion on this point and if you felt that when you received a plan from Mr. Cooper approved by him it had been scrutinized and analysed as fully as possible?—A. From my personal observations, I believe that all plans were carefully examined in Mr. Cooper's office; either by Mr. Cooper personally, or by his able assistant; the latter reporting on all important questions to Mr. Cooper. The fact that even unimportant mismatched connections did not escape the attention of Mr. Cooper's office certainly proves the thoroughness and careful study bestowed on the examination of the plans.

Q. Had you full confidence in Mr. Cooper as consulting engineer and did you feel

that in case of doubt arising in your own mind consultation with Mr. Cooper would assist you materially in arriving at definite conclusions on points upon which you might have certain doubts?—A. Yes.

Q. Did you, during the design and construction of the bridge, consult Mr. Cooper on matters such as are referred to in the previous question and were these consultations of material benefit to you in the designing of the structure? If you can give details, please do so?—A. Considering Mr. Cooper one of the ablest and most experienced bridge engineers in the country, I discussed fully with him all main features of the bridge. His advice and directions were always sought and appreciated.

Q. Was the design of the compression members particularly discussed by you with Mr. Cooper, more especially with reference to the lower chords, and, if so, will you please state precisely what special points were discussed in connection with these members and what were the circumstances that led to the discussion on the details of these members in particular?—A. After the first sections of the lower chords of the anchor arms were constructed in the shops, Mr. Reeves, president of the Phœnix Bridge Company, remarked, in our engineering office, that the lattices on the chords appeared too light and that they were liable to be injured or damaged in handling in the shops and transportation to site. I answered that lattices of any size might be injured and destroyed if carelessly handled in the shop or in transportation. This conversation was reported by me to Mr. Cooper. He answered that he looked into the question of the strength of the lattices while checking the plans and that 'we had 't all right.'

Q. Were you unable to consult with Mr. Cooper at any time owing to the condition of Mr. Cooper's health?—A. No.

Q. How often did you go to New York to consult with Mr. Cooper? How often did Mr. Cooper come to Phœnixville?—A. I visited Mr. Cooper about once a month. Mr. Cooper visited Phœnixville twice during the entire process of designing and constructing the bridge.

Q. Was Mr. Cooper aware that it was the intention to use the big traveller for erection purposes as far as the centre of the suspended span and, if so, in what manner was he made aware of this and was he aware that all of the spans were figured with the big traveller in the centre of the suspended span?—A. Mr. Cooper was aware that it was the intention to use the large traveller for erection purposes as far as the centre of the suspended span, from conversations with me, and owing to the fact that he approved the unit stresses due to the erection based on the above condition.

Q. Will you please file a strain sheet using as your data for dead load stress the actual shipping weights of material constructed together with the concentrated panel loads and the other information called for as in the case of the other stress sheets? Indicate the net sections of each member on this stress sheet in red as constructed and in black as demanded by the stresses under the specification to which you were working and state generally what the comparison between the results is?—A. Exhibit attached (Exhibit No. 104).

Q. What was the first intimation you had that would lead you to suppose that any member in the bridge was showing distress?—A. When my attention was called to the curved condition of chord 9-L, south anchor arm, by Mr. Birks' report, inclosing a sketch of the chord, on August 29.

Q. For what reason were the repairs on the splices at 7-L and 8-L, cantilever arm, not promptly considered and executed?—A. Repairs were promptly considered and submitted to Mr. Cooper for his approval. His decision was awaited when the bridge fell.

Q. Did you, throughout the construction of the work in the shops, keep generally in touch with what was being done? Did you make a special examination of important members before they left the shop? Can you say that chords 9-L, anchor and 9-R and 8-R, cantilever arm, were in perfect condition when they left [illegible] ville? If they were in perfect condition when they left the shops, to attribute the later deformation of these members?—A. I kept g[illegible]

the construction of the work. I examined carefully many important members before they left the shop. I am not able, however, to state in what condition chord 9-L, south anchor arm, or 9-R and 8-R, cantilever arm, left the shops. I do not know to what to attribute the deformation of the members.

Q. Will you please file a stress sheet and indicate upon it all unit stresses as existing in the bridge immediately preceding the accident of August 29?—A. Exhibit attached. (Exhibit No. 105.)

Q. Assuming the bridge to have been successfully completed, what would have been the unit stress in chord 9-L, anchor arm?—A. 21,200 lbs. working stress, including live and dead load and snow.

Q. In your judgment, what was the weakest part of the structure, first, during erection and, second, when completely erected?—A. The compression members of the bridge.

Q. Where, in your judgment, did the initial failure take place? Please give your opinion as to the sequence of the fall of the structure?—A. It appears reasonable to suppose that after the fall the centre of gravity of the top mass of the metal should be on that side of the centre line of the bridge on which the initial failure of any important truss member took place. This condition of the top chords actually existing clearly indicates to my mind that east chord section 9, south anchor arm, failed first, dragging the west chord, section 9, after it. The two main shoes have been pushed off their pedestals towards the south anchor pier by an unbalanced horizontal force over the main pier. This condition was created by the destruction of chords 9, anchor arm, and the release of the horizontal component of chord 10, cantilever arm.

Q. What reason do you assign for chords 9-L in the anchor arm yielding under a unit stress of 18,000 pounds when they were calculated to safely carry a much higher unit stress?—A. The main sections being sufficient to resist the stresses existing on that day, either the detail parts uniting the four ribs failed, or the ribs buckled individually, or both.

Q. In designing the compression members did you exhaust every known source of information and were they designed after the full consideration of all known or available data on the subject?—A. Yes. There were no precedents for designing compression members of this magnitude. Tests made on small pieces do not furnish adequate information for members of many times their size.

Q. What was the largest compression member you had heretofore designed and what unit stresses were used in it?—A. The largest compression member designed by me had 240° and the unit stress was 14,000 lbs.

Q. Did the use of these high unit stresses demand mechanical work in the fabrication of the structure superior to that demanded by work designed for lower stresses?—A. Yes.

Q. In this connection what would you consider the limit of good practice in the variation in lengths of the ribs comprising a lower chord section?—A. One sixty-fourth of an inch (1/64").

Q. Was this variation exceeded in any cases in the construction of the lower chords?—A. Not to my knowledge.

Q. Did the quality of the shopwork meet with your entire approval?—A. Yes.

Q. In the light of recent events have you changed your opinion as to the value of data available for the successful design of large compression members. If so, will you explain in detail?—A. There is no reliable theory established, nor are there any results of extensive tests on compression members on record as regards detailing of these large members. No data exist showing clearly when lattices only are sufficient to unite fully two or more ribs into one rigid unit. There is, no doubt, a limit to the depths of compression members when lattices only may be used, and when, on the centre line of the ribs, in addition to the lattices, a continuous horizontal plate girder must be added. We have no data showing how much more efficient top and bottom cover plates are than heavy lattices, nor do we know when, in addition to top and

bottom cover plates on the centre line of the ribs, girders as above mentioned should be used. All doubt as regards these important features of detailing large compression members should be eliminated by extensive tests, as arguments advanced by theoretical investigations are based on more or less vague assumptions. It is the duty of the entire engineering profession to strive to secure numerous tests to establish rules to be followed in designing compression members of large size, in order to replace or to corroborate present opinions.

Q. Similarly have you changed your opinion with regard to the use of high unit stresses, either in tension or compression? If so, will you give your reasons fully?—A. No; high unit stresses may be used in designing, if members in tension or compression are proportioned by rules supported by actual tests. But under existing conditions, I would not advocate such extreme unit stresses.

Q. In splicing large compression members do you consider that the area of the spliced plates would be sufficient if they represented from 15 per cent to 20 per cent of the area of the member?—A. Yes.

Q. Would you consider that a splice which was to be 60 per cent bolted up was properly bolted if 30 per cent bolts and 30 per cent drift pins were used?—A. Yes.

Q. Did the action of the anchor arm during erection meet your expectations as previously calculated, or did it act in an unexpected manner? Please file a statement or diagram showing the movements of the camber blocking, giving the dates of orders issued in respect to these movements, and when each panel point was released?—A. The anchor arm, during erection, acted generally as expected. Considering the height of the false work (160 feet) the wooden false work foundations resting on natural ground, the variations in the field as compared with the office calculations were insignificant. Exhibits attached (Exhibit No. 105A).

Q. Were there any matters in the process of erection which were brought to your attention which indicated in any way miscalculation? If so, please describe them?—A. None whatever.

Q. Please state as concisely as possible the history of the development of the eyebar system in the bridge, stating what tests were made, and at whose instance; and also giving the general results obtained; and will you please file copies of the blue prints of the eyebar heads that were tested. Were other tests on full size numbers made, and if so, give details?—A. When making the first design for the bridge, in 1897 and 1898, I found that large eyebars must be used. In order to decrease their number, and to thus reduce the chances of errors in boring, to a minimum, and also to obtain shorter pins, 15 inches and 16 inches wide eyebars were considered, not over 2 inches thick, thicker bars being less reliable in testing. This latter feature was especially important, and well known to me since I knew the unreliable and often unsatisfactory results of tests made in our large testing machine for all bridge companies in the United States, on bars over 2 inches thick. I was requested many times by the officials of the company to be sure when determining sizes of eyebars, to keep the thickness, as much as possible, below 2 inches unless it were necessary, in exceptional cases, in order to overcome difficulties encountered in arranging eyebars and pins.

For our information we made preparations to test 15 x 2-inch eye-bars as early as 1900—ten of these bars, 15 x 2 inches, about 15 feet long, were manufactured and tested, with very satisfactory results, in 1901—demonstrating that bars of this size may be successfully forged, and that reliable results may be obtained.

Seventy-three full size tests were made on 10-inch and 15-inch eye-bars between July, 1904 and April, 1907, as required by the specifications, and ordered by Mr. Cooper.

In order to ascertain the character of stresses and resulting strains in the metal of the eyes, the latter were divided by lines parallel with the longitudinal axis of the bars, and by lines at right angles thereto into squares with 2-inch sides. These lines, in their new positions after the tests, were closely examined, and information

useful in designing the size and shape of the eyes. No other full sized tests were made.

Q. Did you visit the bridge site during erection and will you please give the dates of these visits ? Please file copy of your personal diary covering the Quebec bridge work?—A. I visited the bridge in May, 1901; June, 1905; June, 1906; and August, 1907. Copy of my personal diary attached (Exhibit No. 106).

Q. Did you make a personal examination of chords 7-L and 8-L cantilever arm in the structure ? Did you personally examine any chords after erection and on what dates and with what results ?—A. No.

Q. What stresses did you classify as secondary stresses and what secondary stresses did you make allowance for in your design and in what manner did you make this allowance ?—A. Secondary stresses due to the enforced position of the members in the structure were considered; but no allowance was made for them.

1st. In floor beams due to bending induced by railroad stringers during change of panel lengths of trusses. No allowance made as directed by Mr .Cooper.

2nd. In eye-bars due to bending induced by deviation of the bars from longitudinal axis of bridge. No allowance made as directed by Mr. Cooper.

3rd. In end vertical posts of suspended span, due to temperature change. Insignificant.

Q. Mr. Cooper has stated that it is his opinion that the bridge could have been saved by promptly using timber blocking in the chords and strutting and bolts between the chords; what is your opinion?—A. I do not believe that the bridge could have been saved in any such manner.

Q. In the bridge as constructed, were any combinations of wind and loading considered which produced unit stresses in excess of those permitted by the specifications under which you were working and to which you were limited ? Give particulars as to each member so affected ?—A. Combinations of wind and loading assuming load increased by 50 per cent, produce unit stresses in :

Cantilever arm—

Chord 7	25,600
Chord 8	25,900
Chord 9	26,800
Chord 10	26,400

Q. Were these unit stresses approved by Mr. Cooper ?—A. Yes.

Q. Do you consider that this procedure affected the efficiency of the structure, and in what manner and to what extent ?—A. The combination of conditions of loading being improbable, practically impossible, I do not believe that the efficiency of the bridge was affected by the high unit stresses given above.

Q. Please file sketches of both travellers and indicate their loads—weights and maximum concentrations of load ?—A. Sketches of large and small travellers attached herewith. (Exhibit No. 107.)

Q. When was it decided to use the small traveller, and for what reason was the system of erection changed.? Who suggested this change, and did you approve of it ? —A. In order to begin the erection of the north anchor arm early in the spring of 1908, the large traveller had to be removed from the south side, and re-erected on the north side in the fall of 1907, before it was possible to finish the erection of the entire south half of the central span. Therefore, another traveller had to be provided for the erection of the south half of the suspended span, only about one-quarter as large as the large traveller thus effecting a considerable saving of metal in the suspended span.

The use of this small traveller was first suggested, and finally decided upon, by The Phœnix Bridge Company, about January of 1906, with my full approval. The original scheme of erection contemplated the use of the large traveller to the center of the suspended span ; the erection stresses in the cantilever arms were so figured and sizes provided. The stress sheet of the cantilever arm was approved by Mr. Cooper, showing sizes for erection stresses for the above condition.

Q. Please file a stress sheet showing erection stresses only—on the assumption of the big traveller being used to centre of suspended span. Did the change in the travellers as adopted reduce these stresses and to what extent?—A. Erection stresses due to large traveller attached (Exhibit No. 108) stresses in the suspended span, due to small traveller, were only about 25 per cent to 33 per cent of the stresses due to the large traveller.

Q. What calculations were made by you on August 29, in respect to 9-L anchor arm. If you arrived at a conclusion please state what it was?—A. Knowing that every part of the bridge was figured with the utmost care as to its strength, that the results of the calculations were checked and compared at least three times in the Phœnix Bridge Company's office, that they were then sent to the consulting engineer for comparison with his calculations and for his approval, and that they were fully approved by him; knowing further that the shop plans were prepared under my personal supervision by a corps of able engineers and draughtsmen, that these plans were redrawn several times, that they were then sent to the consulting engineer for his study and approval, and that they were all approved by him; knowing further that every part of the bridge was constructed strictly in accordance with these plans; knowing also that the erection was conducted carefully and strictly according to plans prepared by the Engineering Department—knowing all these facts, I was forced to believe that on August 29, 1907, the bridge was in a safe condition, and that no part could show the least sign of weakness due to stress, especially as the loads of the bridge on that day were such as to produce stresses in the truss members only about three-fourths of the stresses the bridge was figured to be able to bear, with entire safety, after its final completion.

It was impossible for me to believe that the bridge was failing or that the amount of curvature in chord 9-L was as reported. Our resident engineer, Mr. Birks, stating on August 29th, on the telephone, that there was no distortion in any lattice, that all rivets were tight, that there was no change taking place in any part of the chord, I was further strengthened in my belief that there was nothing wrong with that member. I made rough calculations of the chord, however, using 14,000,000 lbs. axial stress, and an average curvature for the four ribs of the chord of 1½", and found that even with this improbable curvature, the chord was not in a dangerous condition.

Q. Does the elastic limit given by usual specimen test bear a direct relation to full size tests of plates, and what is it? Have sufficient tests been made to fully establish this?—A. Tests made on specimens of eyebar material show an elastic limit generally of 10 to 15 per cent. larger than full size eyebar. I am not familiar with any full size tests made on wide plates in order to compare results with the specimen tests.

Q. Do you consider that the elastic limit or the yield point of a built up member such for example as two or more plates riveted together, and which are intended to act in unison, has ever been accurately ascertained, it being assumed that buckling does not occur. What relation do these results bear to similar tests of a member of the same proportions, but consisting of one thickness, providing the same area of cross section?—A. I am not aware that tests of this character ever have been made.

Q. Do you consider that a large bridge member under eccentric stress may in time be so altered in form without failure that the irregularity of stress in the metal under the eccentric loading will disappear in whole or in part?—A. Yes.

Q. Please file a list of all groups of calculations that you made in connection with the bridge in chronological order, and state which stress sheets were used in designing the details of each part of the bridge?—A. Lists of calculations, with proper dates, attached (Exhibit No. 109).

Q. File copies of top chord packing which Mr. Cooper refers to in his evidence as having been sent to you by him?—A. Mr. Cooper's packing of anchor arm top chord bars attached herewith. (Exhibit No. 110.)

Q. Please calculate and file a stress sheet showing the stresses in the main truss members of the anchor arm arising from a uniform loading of 6,000 pounds per lineal

foot (3,000 pounds per lineal foot on each track) on anchor arm only?—A. Stress sheet of anchor arm for 6,000 pounds per lineal foot of bridge attached herewith. (Exhibit No. 111.)

The Commission, having for the time being concluded the inquiry in New York, Philadelphia and Phœnixville, returned to Montreal. A second visit was paid to Quebec on November 28, for the purpose of re-examining Mr. Hoare and pursuing other investigations.

RE-EXAMINATION OF MR. E. A. HOARE, AT QUEBEC, NOVEMBER 29, 1907.

Q. Why did you use the Phœnix Bridge Company's design in 1898?—A. Previous to 1898 several picture drawings were voluntarily sent by various engineers desiring to show the merits of their designs. Amongst the number was a study by the Phœnix Bridge Company. At that date, having to prepare a plan to submit to the Railway Committee of the Privy Council to obtain their decision upon the least clearance and width of channel for navigation, I applied the outline for the superstructure of the Phœnix Bridge Company's design to my plan, it being considered at the time the most suitable design submitted.

Q. What instructions were given to Mr. Cooper when he was requested to report upon the various tenders? If these were written, please file copies?—A. Written instructions were given (copy of the same attached herewith, Exhibit 112).

Q. Was any sum mentioned to Mr. Cooper which the bridge must not exceed in cost, and if so what was it?—A. No.

Q. Was Mr. Cooper required to limit the cost of the bridge to any amount, or was the question of cost left entirely to his judgment?—A. The question was left entirely to his own judgment.

Q. Did the weight of the bridge exceed your expectations, and by how much?—A. The approximate weight of the bridge as estimated by the Phœnix Bridge Company amount to 29,700 tons, the actual weight is about 38,000 tons. I fully expected that the original figures would be exceeded by the time all details were designed.

Q. Was Mr. Cooper advised of the terms of the contract of June 19, 1903, and in what manner? Was he furnished a copy of the contract, and if so when?—A. I cannot state definitely if Mr. Cooper was advised of the terms of the contract of June 19, 1903, directly by the company. The secretary states that he did not furnish Mr. Cooper with a copy of the contract.

Q. Mr. Deans has stated that final arrangements were made with the Phœnix Company by the Quebec Bridge Company on February 22, 1904, although the contract was signed June 19, 1903. What was the reason for the delay and what was the final arrangement made February 22, 1904?—A. Although the contract was passed in June, 1903, its execution was forcibly delayed by other arrangements then under way with the government, the passing of legislation and financial arrangements, which were concluded 28th January, 1904. Letters were then exchanged in February between the two companies giving effect to the contract (copies of these letters are attached herewith. (Exhibit 113-A, 113-B, 113-C, 113-D and 113-E.)

Q. Did you find Mr. Cooper accessible and available at all times during the construction of the bridge?—A. He was accessible and available, but only at his office in New York during the design and building of the superstructure.

Q. State exactly the full scope of Mr. Cooper's duties as consulting engineer?—A. Mr. Cooper's duties, in a general way, as consulting engineer for the Quebec Bridge Company and as understood by them, are as under :

To revise the specifications when he thought necessary. To examine all stress diagrams and plans for the structure submitted by the Phœnix Bridge Co., to approve or modify the same from time to time when, as in his opinion, he considered it necessary to obtain efficiency under the powers delegated to him. Receive reports on vital and technical questions affecting the details of construction and uncertainties as to quality of metal tested, for his decision thereon. Also to be available for consultation with the Phœnix Bridge Company and the Quebec Bridge Company at any time on any question arising out of the design or construction of the bridge. Also to visit the work in progress from time to time, and finally pass upon it.

Q. File a statement showing all the payments made to Mr. Cooper by the Quebec Bridge Company?—A. See statement attached herewith. (Exhibit No. 114.)

Q. Did Mr. Cooper ever ask for any inspectors other than these who were appointed and who acted?—A. No. He was entirely satisfied with the inspectors appointed, as shown in his correspondence. He never asked for any other inspectors.

Q. Did Mr. Cooper ever ask for assistance to be given him in his office for the purpose of assisting him in checking plans or for other work?—A. No.

Q. Had Mr. Cooper authority to order expenditures on account of the Quebec Bridge Company for special tests or for engaging assistants? At whose expense were the eye-bar tests made?—A. Mr. Cooper had no written authority to order expenditures for special tests, but he could, as consulting engineer, have ordered any tests to be made that he thought necessary and upon his request any assistants would have been allowed at any time. As assistant inspectors were required from time to time Mr. Edwards applied to me direct and I authorized him to engage all the assistants he required upon terms which he considered fair.

The eye-bar tests were made at the expense of the Quebec Bridge Company, and clause No. 135 of the original specification provides that the 'contractor shall make at his own expense, under the direction of the engineer or his inspector such other tests of full sized members or details similar to those used for the work, as the engineer may prescribe.'

Q. Did Mr. Cooper at any time during the erection of the bridge stop the work, and how was this done? Please file copies of any letters or telegrams connected with this incident, and give your explanation?—A. In June, 1903, Mr. Cooper telegraphed me not to allow posts CIP to be erected until top was made level. Copy of telegram attached herewith. (Exhibit No. 115.) This was on account of the bearing of the top section of the post not being quite uniform. The report of the defects was exaggerated and the work was immediately corrected according to Mr. Cooper's instructions, which were to make sure of a minimum bearing of $\frac{3}{4}$ of the total area.

Q. Did you receive any communication from Mr. Cooper between August 27 and August 30, 1907?—A. No.

Q. Please explain how the staff of inspectors was appointed and organized?—A. Mr. Cooper agreed to assist in that organization and appointed the chief inspector himself, and it was understood betwen us, and adhered to, that the chief inspector at the Phœnix works was to personally report at Mr. Cooper's office in New York at least once a month, and oftener if necessary, upon anything of special occurrence, result of tests, &c., and take direct and final orders from him. Mr. Cooper suggested, and I agreed with him, that it would be advisable to endeavour to obtain qualified men in Canada. I spent some time making inquiries, but found that all the qualified men were engaged. One or two doubtful applicants, I requested to communicate with Mr. Cooper direct. Finally, as I could not secure qualified men, I asked Mr. Cooper to nominate the chief inspector, which he did. The chief inspector having had some 20 years' experience, was always in touch with men of his class, and whenever extra inspectors were required for mills and shops he applied to me for authority to engage them upon their own terms, which were agreed to without exception, and they all proved to be very efficient men, thorough and conscientious in their duties. From detail reports received and from my own visits to the works at Phœnixville and mills at

which steel was rolled, as frequent as distance would allow, I am able to testify to the above facts.

Respecting the erection inspection, Mr. McLure was recommended to Mr. Cooper for the chief field appointment. He appointed him under certain conditions, to work under Mr. Edwards, the chief inspector at the shops, until he was required for erection. Knowing that it was important that Mr. McLure should remain at the Phœnix shops as long as possible to master the work outlined by Mr. Cooper, I charged Mr. Kinloch (an experienced bridge erector appointed by me), being already on the spot, to attend to the mechanical part of the work, starting with the inspection of the metal as it arrived at the storage yard; it was never the intention to permanently substitute Mr. Kinloch for Mr. McLure, but as Mr. Kinloch was competent to inspect alone on the start—I thought that for the time Mr. McLure was better employed in Phœnixville—and as soon as the field office was ready I sent for Mr. McLure. The laying of the lower chords in the false work was well advanced at that time. The instrumental work for the false work foundations and construction was attended to by engineers under my own supervision, using plans with figured data; the chords being set to fixed levels, were never changed after Mr. McLure arrived. He, however, arrived in plenty of time to supervise the checking of the position of the main pier pedestals.

Mr. Cooper had no right to state that he thought Kinloch and myself did not understand the operations at that time, being without positive knowledge of the facts, and to incorrectly assign that reason for sending for Mr. McLure at that late date. Mr. Cooper, moreover, could not have been aware that many of the important features submitted to him throughout the whole work of erection were due to Mr. Kinloch's searching inspection.

Q. Why did not you, as chief engineer of the Quebec Bridge Company, certify to the plans and other drawings before they were forwarded to the Department of Railways and Canals?—A. To make a thorough check of such a mass of plans would have taken a very long time after they were received, and caused unnecessary delay, and which I considered an unnecessary operation, knowing that these plans were most thoroughly checked by experts before they reached my office, and knowing, at the same time, that they would receive further examination on reaching the Department of Railways and Canals.

Q. What responsibility had you as chief engineer of the Quebec Bridge Company in connection with the final specifications and plans?—A. I had no responsibility in connection with the final specifications and plans. Full power was delegated to Mr. Cooper, by the order in council dated August 15, 1903, to modify the original specification and to regulate the detail parts of the structure to obtain the best efficiency, final approval to be given by the chief engineer of the Department of Railways and Canals.

Q. Were you immediately responsible for the inspection of construction both in the shops and field?—A. It was a joint responsibility divided between the consulting engineer and chief engineer, but I deferred to Mr. Cooper's judgment. My former statements with regard to the inspectors will explain this.

Q. Please state what your annual remuneration has been since your connection with the Quebec Bridge Company?—A. From November 1, 1900, $400 per month, until the completion of the bridge and railway connections and terminals. From September 5, 1905, voluntarily raised by the company to $6,000 per annum. For three years previous to the first date, $150 per month.

Q. During this period were you under salary for any other company or individuals, if so, please give full details?—A. For about two years I have had charge of the viaduct over the Cap Rouge valley, on the Transcontinental Railway, which did not require any more attention than the construction of the Quebec Bridge and Railway Company's railway approaches under my charge, work on which during that time, was temporarily suspended. This did not interfere with my work in connection with the bridge.

Q. What salary did Mr. McLure and Mr. Kinloch receive?—A. Mr. McLure

received $1,800 per year and travelling expenses, and Mr. Kinloch received $1,200 per year and travelling expenses.

Q. Were you accessible and available at all times during the construction of the bridge or did your other duties interfere with this condition; especially, could the inspectors at the bridge have communicated with you promptly on the discovery of the deflection in chord A-9-L on August 27?—A. I was accessible and available at short notice at all times during the erection of the bridge, except when en route to and from Phœnixville. My other duties did not interfere in any manner whatever. The inspectors could have communicated with me promptly on the discovery of the deflection in chord A-9-L on the 27th August.

Q. Did you consider throughout the whole of the work that the approval of the plans by the Department of Railways and Canals was a condition precedent to any operation in connection with the fabrication of the bridge?—A. Yes.

Q. Why did you permit the fabrication of any part of the bridge before the approval of the plans by the Department of Railways and Canals?—A. To my knowledge there was no fabrication of any part of the bridge before the approval of the plans by the Department of Railways and Canals, but the chief inspector at Phœnixville informed me that the Phœnix Bridge Company had the consent of the consulting engineer to roll a limited quantity of metal for the sections that he had approved, entirely at the risk of the Phœnix Bridge Company. I understood at the time that the consulting engineer had agreed to this proceeding on account of the pressure in the mills to avoid delay in the fabrication of the metal required for immediate erection, to make sure of the delivery of the parts required for the season's erection. I protested against this proceeding, but was assured that the completed detail plans would be in my hands for submission to the Department of Railways and Canals before fabrication. Knowing that Mr. Cooper had given his consent to the rolling of a limited quantity of metal, subject to the Phœnix Bridge Company's risk, I requested Mr. Edwards, the chief inspector, to omit the metal rolled ahead of certified plans in his monthly returns to me.

Q. Why did you not wire Mr. Cooper on August 27, when the deflection in chord A-9-L was discovered?—A. When the deflection in chord A-9-L was reported to me on the evening of August 27, after conversation with the inspectors, and from their description, I did not consider that there was any immediate danger to be apprehended, and considered that there was time for Mr. McLure to go to New York and Phœnixville the next day with sketches to make personal explanation of the same, in order that there might be no misunderstanding. Full reports having been mailed the same day, a telegram at that late hour would not convey the information nor reach its destination without some delay, as telegraph operators were on strike at the time, and besides that, I requested Mr. McLure to make sure that his information was complete, and that a thorough inspection of the other members of the bridge should be made the first thing in the morning, in order to be thoroughly informed of all conditions before he left. I, however, wired both Mr. Cooper and the Phœnix Bridge Company next morning that Mr. McLure had left to give full explanation with reference to the deflected chord previously reported by mail.

Q. Why did you not stop work on the bridge on August 28, pending Mr. Cooper's decision, and with the information you had in regard to the condition of some of the compression members?—A. I did not stop the work on August 28 for the following reasons : I did not consider the conditions warranted such action, particularly as the Quebec Bridge Company's inspectors and the Phœnix Bridge Company's engineer and foreman disagreed upon the origin of the deflection. The latter showed no signs of uneasiness and were anxious to continue the work, as they had made a special effort to collect a large force of bridge men. As I understood it, the majority of the men were engaged removing the large traveller and riveting and they would very little extra load until expected instructions were received from the consu engineer upon Mr. McLure's arrival. My confidence was strengthened

[illegible] The Phoenix Bridge [illegible] Mr. Cooper. [illegible] Mr. Cooper [illegible] Mr. Cooper [illegible] Mr. Cooper

on the work, and in addition frequent visits were made by other engineers from Phœnixville to examine the work in progress.

Referring to Mr. Cooper's reply to the question relating to the qualification of engineers employed by the Quebec Bridge Company or Phœnix Bridge Company, &c., Mr. Cooper nominated a man of his own choice to represent him on the erection, to work under his own special instructions, to keep him in touch with the work, and to my personal knowledge his duties were thoroughly and most conscientiously performed and all instructions strictly followed. Mr. Cooper expresed his satisfaction with that arrangement, and if he had any doubts as to the efficiency of other members of the local staff, I am surprised that he did not make his views known to me. My general duties for the Quebec Bridge and Railway Company were not known to Mr. Cooper, and possibly he did not know that I kept in close touch with every detail of the work performed in the shops and mills as well as in the field; also followed the progress of work between the Phœnix bridge engineers' office and Mr. Cooper, to know how matters were progressing without interfering with the special duties of the consulting and designing engineers.

Referring to Mr. Cooper's reply to the question, 'Was it the practice of the Quebec Bridge Company's staff to refer all difficulties to you, and if so what were the duties of the chief engineer?' although Mr. Cooper may have performed some of the duties incumbent upon a chief engineer, he did not know, as I previously stated, the general duties I had to perform for the company. Mr. Cooper never asked for any staff of assistants or any allowance for the same.

With reference to Mr. Cooper's reply to the question 'Who authorized the commencement of the erection of the suspended span before the large traveller was taken down? was it understood that this was to be done and did this procedure have your approval?' Mr. McLure's reports and photographs to him in New York showed that the big traveller was not entirely removed before the accident. I regret that Mr. Cooper did not notify me of this understanding about entire removal of the big traveller, as I would have insisted upon his instructions being carried out. The proper channel for conveyance of any instructions for important and prompt action is through the company's engineer at Quebec.

Mr. KINLOCH, re-examination.

Q. What employee of the Phœnix Bridge Company was particularly responsible for the bolting up of the joints during erection?—A. I understood that it was the duty of Mr. Birks to see that this was properly done.

Q. To your knowledge were the blue print instructions concerning the bolting up of joints fully complied with?—A. I am certain that they were fully complied with at all points except on the bottom cover plates of the lower chord. As it was essential to remove these plates and to keep them off for a period of probably ten days while the riveting of the joints was in progress, I did not consider it necessary to make a close inspection of this bolting and am not prepared to saw how fully it was done.

Q. Were the bolts inspected for tightness or changed during the interval between erection and riveting?—A. All holes in the inner ribs of the lower chords were filled at erection with the largest bolts that could be put in and these were not changed again until the riveting gang reached the joint. As the joints closed the bolts in the outer ribs became loose and were generally replaced by larger bolts, but this was not done on many joints of the lower chord.

Q. How often were the joints inspected to see how the bolts were acting and whose duty was it to make these inspections—A. The joints were examined every time the traveller was moved forward by the inspectors of the Quebec Bridge Company and by the engineers of the Phœnix Bridge Company until each joint had taken its full bearing. These inspections were part of the general examination of the structure—

edge that very careful work had been performed by expert designers who had been entrusted with the calculations and preparation of the plans of the bridge, and that at the time the chord was not strained over ¾ the maximum provided for and that a mistake was impossible under such conditions; and it was also reported to me that the ribs had a full bearing at the splices.

Q. In your opinion, could the bridge have been made temporarily safe in some such manner as has been suggested by Mr. Cooper?—A. No.

Q. Did you discuss the advisability of staying the lower chords, and if so with whom did you have this discussion, when was it, what were the methods proposed and what was the decision, and why did you reach this decision?—A. The Phœnix Bridge Company officials and myself did discuss the advisability of staying the chord in question. Several methods were proposed, and when it was known that the work could not be completed before a message from Mr. Cooper could be received, it was decided to abandon the idea and await telegraphic instructions from Mr. Cooper, which were expected upon Mr. McLure's arrival, but never received. From his silence after Mr. McLure's arrival, I concluded that he considered the situation to be void of danger. If he thought otherwise a telegram to me could have been made the basis of an order to stop the work, as he did in June last year for a matter of very much less importance. The confidence that we all had in the general conditions existing at the time, and in the men in charge of the designs, and my knowledge that the work had been subject to so many methods of checking, and with members in the bridge still to be stressed a considerable amount to reach the maximum, for the time being obliterated any impressions of danger being possible, and no doubt he himself was not impressed with any sense of immediate danger.

Q. Please explain the contradiction in your letter of September 2, 1907, to Mr. Cooper to the statements contained in your letter of August 28 to him?—A. With reference to these two letters. On my arrival from the bridge late in the evening, in my anxiety to convey to Mr. Cooper by the same evening's mail a full description of the chord and to keep him informed of what had happened since Mr. McLure left, I dictated a letter hurriedly and did not read it over before signing it. In my haste I did not state exactly what I intended with reference to the continuance of the work. Afterwards I noticed my misstatements and corrected them in a second letter, and this letter correctly states the facts.

Q. Have you any further evidence to offer the Commission?—A. Referring to Mr. Cooper's answer to the question, 'Did you at any date ask to be relieved of your duties and for what reasons? If you made such a request, at whose instance was it withdrawn?' Mr. Cooper's conversation with Mr. Parent and Mr. Deans suggesting relief from his duties and stating that he could not go to Quebec was unknown to me.

Referring to Mr. Cooper's reply to the question as to proper time being allowed for preparation and study of plans, Mr. Cooper never complained about that. Besides he was the chief and could have refused to approve plans if he thought that sufficient time was not allowed for their study, verification and correction.

Referring to Mr. Cooper's reply to the question, 'What organization existed for the checking of the strain sheets and detail plans prepared by the Phœnix Bridge Company?' Mr. Cooper made his own proposal for remuneration to cover all services, which were agreed to by the company and acknowledged by him as being correct. He never before complained that duties were imposed upon him improperly, and to my knowledge he was satisfied with the staff and refused to concur in the appointment of an engineer suggested by the government of Canada.

Referring to Mr. Cooper's reply to the question, 'Was the local staff at Quebec employed by the Quebec Bridge Company and the Phœnix Bridge Company to your satisfaction, and did you consider it fully competent to handle the work?' Mr. Cooper had sufficient interest in the work to have ascertained at an early date the class of men conducting the erection, and if he did not consider the staff sufficient he could have informed the company. The Phœnix Bridge Company always had engineers

on the work, and in addition frequent visits were made by other engineers from Phœnixville to examine the work in progress.

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following each traveller's movement, and the bolting of the joints was observed and any change of bolts that was noticed to be needed was ordered. The representatives of the two companies worked together in these examinations.

Q. Are you positive that the bolting on erection was always in excess of the office requirements ?—A. Yes.

Q. Were §-inch bolts used to any large extent in the lower chord joints ?—A. No, I do not think that §-inch bolts were used in more than two joints in the anchor arm and in two joints in the cantilever arm and then only in the rows of holes near the top of bottom splice plates, this being determined by the setting of the camber openings.

Q. Were drift pins used in the lower chord points ?—A. In the top cover plates of all joints the majority of the holes connecting with the two centre ribs of each chord were filled with drift pins, the remainder being filled with bolts, the reason for the use of the drift pins being the difficulty of tightening up bolts in these holes, because of the narrow space between the two inner ribs. As the joints closed, the drift pins were driven up from time to time and the bolts between the cover plate and the two outer ribs were changed whenever a larger sized bolt could be entered.

Q. Do you consider drift pins to be an efficient temporary connection for bridge work ?—A. If the drift pins are long enough to get a full bearing on all the connecting plates, I consider that 50 per cent drift pins properly distributed may be used in tension joints with advantage. I am not in favour of using drift pins in compression joints but their use is sometimes necessary as in this case. The objection to drift pins is that having no heads or nuts they cannot prevent the joint plates from buckling up when under compressive stress.

Q. What was the longest time that any bottom cover plate was off?—A. The plate between chords 7-L and 8-L cantilever arm was off from about the first of August, 1907, until the day of the wreck.

Q. Did you observe any joints in the lower chord in which all four webs were not bearing equally when the joint was closed?—A. I have already given evidence concerning the mismatching of adjoining chords for line. When the chords were first set I noticed in several cases that one rib would show on top an opening of perhaps ½ inch when the other three were in contact. At the time of erection the openings at the bottom of the ribs could not be seen on account of the bottom cover plate. No rivetting was permitted on the joints until the four ribs at the bottom and the tops of the two outer ribs were in absolute contact. We could not test the tops of the two inner ribs because the upper cover plate was never removed after it had once been put in place. I am of opinion that the openings that I saw at first at the joints were closed up by the compression of the metal in the longer ribs.

Q. Did you ever observe openings in rib more than at a joint?—A. I have seen two openings, both of which were on the centre ribs, in one joint when the outer ribs were in contact.

Q. Do you remember any joints in the structure which did not close as expected? —A. The joints on both sides between chords 9 and 10 and also between chords 5 and 6 on the anchor arm were very slow in closing, and did not finally reach the proper position for riveting until after August 1, 1907. Some joints on T-5 and T-50 anchor and cantilever arms never reached their final position. There were also several longitudinal and lateral bracings near the main post that had not been got into position and riveted at the time the bridge fell.

Q. Please describe the movements that you think took place when the bridge was falling?—A. The initial failure, I think, occurred in both lower chords No. 9 anchor arm simultaneously and in the latticed portion of the chords, but not in the same way in both chords. No. 9-L, which had previously been observed to be bent, deflected slowly and transferred some of its load to 9-R, until that chord burst with a sudden fracture accompanied by the loud report testified to by some witnesses. The sudden and complete collapse of 9-R whilst 9-L was slowly yielding accounts for

the slight swing of the cantilever arm down stream and for the tendency of the upper portions of the anchor arm to fall in the same direction. At the moment of collapse the thrust of the cantilever arm forced the feet of the main posts off the pedestals and the shoes of the main posts were the first part of the structure to strike the ground. Whilst they were in the air the extremities of the stub chord on the cantilever arm struck the inside coping of the main pier a glancing blow. When the shoes struck the ground that part of C-P-6 above the patten plates failed, and simultaneously the horizontal strut connecting the two shoes was destroyed. The transverse diagonal bracing between the two posts at the bottom remained intact for an instant and almost the entire weight of the main posts and of the top chord was concentrated upon it, causing the bracing to act as a toggle and to force the shoes and the feet of the main post out sideways. This is shown by the holes made in the ground. This action threw the bottom portions of the centre post out of the vertical and permitted the feet of the P-4 posts with the broken ends of A-8 attached to them to pass inside the centre posts, some part of P-4-L striking C-P-6-L heavily as it fell. During the fall chords 10-R and L cantilever arm, which had probably broken loose when the stub chords struck the pier, rested for a moment on top of the pedestals, and were then partially suspended and thrown over on their sides, as they now lie on top of the pier, by the wreckage of S-P-5 and of the pieces connected to it. Chords 9 of the cantilever arm did not strike the pier before they reached the ground, although they now lie with their ends just against the face of the masonry, which is slightly marked. Chord 9-R of the cantilever arm is lying in the water with its two inner ribs practically straight and its two outer ribs buckled back in a V-shaped loop about 18 or 20 inches long at a point about 20 feet from the shop splice, the ends being parallel to the inner ribs. Chord 9-L is buckled at about 15 feet from the field splice in all four ribs to a shape similar to that shown by A-1-R, but with a smaller deflection.

Q. Please relate the occurrences following your discovery of the bent chord on August 28th?—A. Immediately after discovering the bend I brought the matter to the attention of Mr. Yenser and Mr. Birks, and with them re-examined both chord A-9-L and several other lower chord members. We did not know what to make of the matter and then went up to our office and arranged with Mr. McLure to have the deflections of the suspicious chords measured—this measurement which was made by Birks, McLure and myself showed the extent of the deflections; and their cause, and their ultimate result immediately became a matter of very active discussion. Mr. Birks expressed himself definitely as being of opinion that there was no danger and endeavoured to persuade me that the bend had always been in the chord. Mr. Yenser and I were uneasy, and considered the matter serious, and finally suggested that McLure and Birks should go to New York and Phœnixville for advice. It was considered that the matter could not be satisfactorily explained by telegraph or telephone and no one of us expected immediate disaster. Mr. Birks and Mr. McLure did not welcome our suggestion saying that they would only be laughed at on arrival and it was finally agreed to refer the matter of sending to headquarters to Mr. Hoare, who decided in favour of our suggestion. Mr. Hoare visited the bridge on the Wednesday and spent most of the day there. He appeared very anxious that I should abandon my position of being positively convinced that the bend had occurred since the erection of the cantilever arm was completed, and argued both this and some possible methods of strengthening the chords by bracing several times with me. I was somewhat excited and much annoyed at the unwillingness of all the engineers to accept my statement of facts and on both Wednesday and Thursday avoided further discussion of the matter as much as possible. It was understood that McLure would immediately wire me if Mr. Cooper took a serious view of the situation, but this he failed to do. Mr. Birks, however, told me on the morning of the 29th instant that he had been advised by 'phone from Phœnixville that they had a record which showed that the bends had been in the

cord before it was shipped from Phœnixville and that he had just advised Mr. Hoare by telephone at the request of Mr. Deans to that effect.

Q. Did you find that the officials of the Phœnix Bridge Company were anxious to get such assistance and advice from the local staff of the Quebec Bridge Company as they could or were they somewhat impatient of criticism ?—A. In matters of details I found that they valued my opinion, but in general they claimed that their plans of erection were fully worked out, and stated that they would permit no interference with them except by the chief engineer personally.

Q. Do you consider that the supervision over and control of the operations of the Phœnix Bridge Company on the work were closer and more exacting than the similar supervision that has been exercised on other large bridges upon which you have been employed as an inspector ?—A. The control of this work differed from that of any other upon which I have been employed in this respect, that every question between the inspectors and the contractors was referred to New York and Phœnixville for settlement, whereas in my previous experience the power to settle most questions was vested either in the inspectors or in a resident engineer who was always on the work.

Q. It has been stated by witnesses that general foreman Yenser cared only to rush up steel as fast as possible—what is your observation ?—A. Yenser was a hustler, and like every other erector liked to get up as many tons of metal in a month as he could, but I do not recall that he ever took any serious risks in doing so, and in fact I was informed by Mr. Milliken that the inspection of Mr. Birks was especially provided so that the Phœnix Bridge Company might get the full advantage of Mr. Yenser's energies without anything being done contrary to the wishes of its engineering department. I consider that Mr. Birks' inspection was carried out with singular thoroughness and good judgment.

Q. Have you made the investigation of the appearance of the lower chord joints mentioned in your previous evidence?—A. I have examined them but could detect nothing to indicate that the ends of the ribs were unevenly stressed in the fall by reason of the original camber openings.

On December 3 a member of the Commission again visited New York to further examine Mr. Cooper, returning on December 8.

ROYAL COMMISSION, QUEBEC BRIDGE INQUIRY.

I, Theodore Cooper, consulting engineer, of the city of New York, in the state of New York, one of the United States of America, make oath and say:

1. That I attended before the Board of Royal Commissioners appointed under the Great Seal of Canada to enquire into the causes of the collapse of the Quebec bridge, on Wednesday, Thursday and Friday, the 3rd, 4th and 5th days of December, 1907.

2. That the annexed 28 pages contain my present testimony, and that the answers to the questions are true.

Sworn before me in the said City of New York, this 7th day of December, 1907, by the said Theodore Cooper, who is personally known to me.

Mr. COOPER'S testimony.

Q. When the various plans and tenders were submitted to you for report, what instructions were you given by the Quebec Bridge Company, by whom and in what form?—A. Mr. Hoare's letter of March 18, 1899, states that certain plans which he enumerates, had been sent to me by express. He adds, 'I will send later copies of tenders and conditions submitted with each. In the meantime, will you kindly inves-

tigate the merits of the cantilever plans and the Union Bridge Company suspension plans until you hear again about two other suspension designs.' That covers the substance of that letter, which is quite long. In his second letter of March 19 he speaks of the non-necessity of examining two of the suspension plans as the conditions of the Dominion Bridge Company's design were impossible. Then there is also the letter of March 21, 1899. On March 23 I had not yet received the plans, and on that day he sends me a telegram, 'Plans should reach you this evening. Transportation delayed by snow.' I did not receive the plans for some days afterwards. On April 4, Mr. Hoare telegraphed that he would be in my office. The effect of all this correspondence is that I was free to take up the plans and determine what I thought was the best plan; there were no special instructions favouring any one plan or in any way directing or guiding me in any one direction. I considered then, as the impression on my mind now is, that I was absolutely free to make a report on the plan I considered the best. Mr. Hoare was the only person who gave me any information, or you might say instructions, and the instructions were more in the direction of not considering certain plans, because they were incomplete or imperfect or had been withdrawn. The Pencoyd Company withdrew their plan and the Dominion Bridge Company practically withdrew their suspension bridge plan on account of the impossibility of getting any sub tenders for the wire work; so that left the matter practically between the three cantilever designs, two of which were identical, those of the Dominion Bridge Company and the Keystone Company, there apparently being some understanding between them to have the same plan and divide the contract in some way or other; so that really there were only two competitive plans that fully complied with the requirements of the specifications and tenders, those of the Keystone Bridge Company and the Phœnix Bridge Company. The Keystone Company's weights were higher and their bid was also higher. The Phœnix design was a far better design, in the form of the design and its general arrangement, the arrangement of the railroad system was better, and it had the advantage of being a lower price. I would state here that all the tenders were in the form of a lump sum, but they gave a schedule of rates and prices which were to be used for estimates for progress estimates.

Q. In your former evidence you referred to limitations that existed at that time as to the amount of funds apparently estimated for construction. What information had you as to the amount of money available, and by whom was this information transmitted to you, and were you instructed that the expenditure should not exceed any certain sum and if so what was this amount ?—A. During the early progress of the work it was an open secret that the Quebec Bridge Company had but a small amount of money in sight. When the contract was let to the Phœnix Bridge Company in 1903, and I was preparing these specifications which were the ones on which the structure was afterwards constructed I received, on June 15, 1903, the following telegram from Mr. Hoare : 'Will your specifications reduce Phœnix weight in their contract draft?' I replied by telegram 'Don't know Phœnix contract weight. New specifications will make slight reduction over old specification for the present span.'

I then received another telegram from Mr. Hoare, dated June 16th, as follows : 'Trusses, towers and floor beams 29,300 net tons.' That same day I wrote to Mr. Hoare saying in part 'I know nothing as to the contract draft or what they now propose. If they have given an estimated weight I wish you would send it to me. Also it would be a guide to me if I knew whether the proposal is for a lump sum price or for a pound price. Also whether 'the powers that be' desire to keep down as close as possible to the original estimates or are willing to go higher if the bridge can be bettered. I am only aiming to get all parts harmoniously strong and not have some parts weaker relatively than others.'

From that time on, during all the formative part of the work, I was repe told by Mr. Deans, Mr. Szlapka and Mr. Hoare personally at various times desire that Mr. Hoare had that the weights in the contract shoul

Even Mr. Edwards mentioned at different times that Mr. Hoare was showing great anxiety—I do not know whether by letters to him or simply by letters to the Phœnix Bridge Company—that the weight estimated should not be exceeded. At a later date, or practically for the last two years there has been no such indication, but the strength and size and dimensions of the work were all determined and formed during this early stage when the impression was on my mind through these different sources that the original weight must not be exceeded. The point governing my mind in preparing a new specification, as I have stated in my previous testimony, was to get a better bridge for the purposes of transportation than was called for under the original specifications. While I felt that I had no right to involve the Quebec Bridge Company in greater expenditures than they anticipated I aimed to get a bridge which would be substantial, economical and better than the one that was originally proposed.

Q. In making your decision between the competitive tenders, did you consider it to the then interest of the Quebec Bridge Company to recommend the acceptance of the lowest tender that would give a safe and satisfactory structure ?—A. I certainly did.

Q. Would you under any circumstances have recommended the acceptance of plans which would not in your opinion have given a safe and satisfactory structure? —A. No, I would not.

Q. Were your representations to the Quebec Bridge Company's representatives sufficiently definite and emphatic with regard to your desire to be relieved of responsibility as to draw forth any protest on their part, and if so was there any repetition of your desire. Or did the matter drop on your part, and did you continue without further protest as consulting engineer ?—A. I do not know that I could say anything fuller than I did in my previous testimony. I notice that that testimony is confirmed by Mr. Deans in his evidence. As a matter of fact, I did continue as consulting engineer, although my condition of health has not improved in the meantime.

Q. We understand that the original agreement was that you should spend five days per month at the bridge site, and that you requested to be relieved of this obligation. Were you thus relieved by the Quebec Bridge Company, and if so, how was it arranged?—A. This understanding is not correct. I have here my original memoranda made at the time of the first interview with Mr. Parent, Mr. Hoare and Mr. Barthe, and my offer to them was to act as consulting engineer at $7,500 if I was not called on to be more than five days out of New York in one month. That proviso of not being more than five days out of New York per month is one that I have been compelled to make for the last twenty-five years in all my agreements to act as consulting engineer. Experience has shown me that parties out of New York do not value the time of a consulting engineer as of any importance, and when called to a distant point for consultation on work for which I was acting as consulting engineer I found great waste of time; the directors would not think it important to meet at the time stated, they would postpone the meeting for a week and think it my duty, being their consulting engineer, to await their convenience. This compelled me in all my agreements as consulting engineer during the last twenty or twenty-five years to put in a clause limiting the number of days that any corporation could command my time. This does not mean that they could not have all the time that was needed for their work, but it was intended to limit them so that they would promptly give attention to business upon making an appointment. That was the bearing of this proviso as to the five days out of New York. Several times during my visits to Quebec I have found this clause a protection. I have left three or four days before a meeting of the board which was postponed, my good friends assuming that I would enjoy that spare time at Quebec, forgetting that I had other business of importance to devote my time to. It was never intended to be interpreted that I must spend five days in every month out of New York, although that was the interpretation put upon it by Mr. Barthe at the time of the presentation of my first bill, that I had not been five days in Quebec. I immediately protested that that clause had no such meaning. I will state that in all my experience as a civil engineer I have never had to apply this

restriction, nor have I ever limited the number of days devoted to any piece of work; but nevertheless it has been a safeguard.

Q. Do you assume the full responsibility for the change from a 1,600 feet to an 1,800 feet span?—A. I assume the full responsibility for the change to an 1,800 feet span.

Q. From your observation, are you of opinion that the preliminary studies and surveys in the neighbourhood of the bridge site were sufficiently thorough, considering the magnitude of the undertaking?—A. The profile furnished by the chief engineer, which accompanied the plans, showed a gentle slope of the bottom extending out a certain distance and then a steeper slope towards the centre of the river. The piers for the 1,600 foot span were placed on or near the crest of the steeper slope. This position of such important piers, appeared to me, with the slight knowledge that I could obtain in regard to the character of the bottom and the tendency of the river as fraught with danger. The sinking of the piers at this point also necessitated a far greater depth of foundation and an execution during the short season of the Canadian summer. Impressed with these facts and also with the fact that the cost of piers further in shore would be materially less, I recommended in my supplementary report that consideration be given to the question of increasing this span from 1,600 feet to some greater length. I was authorized later to make a report upon the question of increasing the span from 1,600 feet to 1,800 feet. I found that the saving in cost of the piers, assuming the computations given by the chief engineer for the two caissons to be correct, was not much exceeded by the increased cost of the superstructure for the additional length. The experience obtained in sinking the piers now existing to depths far less than would have been needed if the 1,600 foot span had been retained I think will satisfy anybody acquainted with the work that the change was an absolute necessity. The founding of the present piers exhausted the full season during each summer of the construction. A greater depth would have been almost impracticable as it would have been impossible to maintain air pressure for the piers further out and every one versed in foundation work will recognize the risk of leaving uncompleted piers, sunk by pneumatic process, without the sustaining effect of the pneumatic pressure, which the running ice would have rendered it impossible to convey to these piers. The preliminary studies and surveys in the neighbourhood of the bridge site were very slight compared to the importance of the undertaking. There were no profiles taken, until a later date, at any other point across the river except upon the centre line of the proposed structure. The knowledge of the river bottom, 500 feet above or below the bridge, was a matter merely of conjecture. When founding the pier on the south shore, having no knowledge of the local conditions, of the regime of the St. Lawrence river, I required that additional profiles should be taken at 500 feet and 1,000 feet above the bridge and I unearthed at that later, 1902, a map of the Canadian Hydrographic Survey taken at this point in 1894. At this same time Dr. Ami of the Canadian Geological Survey was in Quebec and I got him personally interested in the borings and excavations being made, and finally succeeded in getting him officially instructed to make a report upon the geological conditions of the material on which the piers were founded.

Q. Do you assume the full responsibility for the change in the specifications, and for the selected unit stresses?—A. I assume the full responsibility for the changes in the specifications and for the selected unit stresses.

Q. What were your reasons for adopting the unit stresses specified? Please state the data upon which you founded your conclusions?—A. First, as stated before, I desired to get a better bridge without increasing the estimated weight and for that purpose I lowered the wind strains, increased the train loads and changed the formula for the determination of the unit strains. I took up the investigation of the original Phœnix design for the 1,600 feet span, examined into the sizes of the members and the unit strains employed in preparing this design, such strains being made and proportioned according to the original Quebec bridge specifications. Looking at t

figures I find under cantilever arm, lower chord, that the end panel at the tower contains 740 square inches and was being worked to a unit strain of 21,100 lbs. Similarly in the anchor arm the end panel at the tower was being worked to a unit strain of 21,100 lbs., the fourth panel from the tower, anchor arm, to 20,580 lbs. As my studies proceeded I tested the dimensions of these members under the new requirements by an assumption of using as high as 24,000 lbs. for the dead load, and found that my design instead of 21,100 lbs would have 21,400 lbs. In another case where they had 21,800 lbs. I would have 21,200 lbs. In another case where they had 21,520 lbs. I would have 21,200 lbs. That was my first study to find out whether the new bridge was going to be of proportionately greater weight than the original plan, and I found that I was going to use no higher unit strains than had been used in the original first design.

I then took up the report of the Forth Bridge, which I had read before, to refresh my memory, and I found that Messrs. Baker and Fowler, the engineers of that structure, had adopted 10 tons, or 22,400 lbs. for the constant or dead load and 6⅔ tons, or 14,933 lbs. for the changeable or living load. While it is not definitely stated the impression left by reading the reports is that these strains were employed in the design of the Forth Bridge, and that the working strain is about 20,000 lbs. on the Forth Bridge and that aimed at for the Quebec bridge was 21,000 lbs. This I considered as a fair comparison for the reason that the Forth Bridge, as far as any evidence has been presented, was constructed without any regard to the camber requirements, without any regard to any such delicacy of measurement of length of members, as we endeavoured to obtain in the ordinary bridge construction in America. I therefore felt satisfied that the strains I had adopted for the Quebec bridge were undoubtedly within the strains that were employed for the Forth Bridge.

My experience of many years in the study and examination of existing structures in the United States on many of our railroads where structures were vastly overstrained from the increasing train loads (not infrequently double those originally designed) gave me great confidence in the use of high unit strains when the loads are definite and clear. In other words, I have no hesitation in believing and expressing my faith that two-thirds of the elastic limit of the material, for a positively known load, is a safe strain. But there is no case in the design of the Quebec bridge where any such strain as two-thirds of the elastic limit could have been expected. While a limitation was placed in the specification to restrict the strain to 24,000 lbs. for an increase of the specified live load of 50 per cent, this load is an absolute impossibility on any railroad in the United States, except where they are carying pig iron one way and ores the other. It must be borne in mind that the strains on the Quebec bridge were determined for heavy train loading upon both tracks. I do not believe that the actual train loads which would cross the Quebec bridge would ever equal, certainly they would not exceed, the requirements of my specifications nor do I think that the working strains under practical train loads, would ever exceed 21,000 lbs.

Q. Did the unit stresses used in the specifications exceed the then accepted practice in bridge construction?—A. Certainly, but this was an exceptional bridge of exceptional length, and high strains were justified because the greater weight was that due to the weight of the structure itself, and any small uncertainty in regard to the live load would be comparatively a minor factor.

Q. Would the actual unit stress in the anchor arm in the completed bridge have been unprecedented in bridge building?—A. Yes, I believe so, with the exception of the Forth bridge, the only bridge to which it can be at all comparable.

Q. Were the specified unit stresses exceeded in the anchor arm, and, if so, why were they permitted and approved by you?—A. The specified strains in the anchor arm were exceeded by reason of the weight of the structure exceeding that originally given me by the Phœnix Bridge Company as the weight of the bridge. Before this increased weight of structure was discovered the anchor arm was practically built and erected. When I was able to sum up the shipping weights of the different members of the anchor arm and obtain the weight of the anchor arm as a whole, I found

it exceeded the original estimated weight. There was no means of changing or correcting this work. I made an estimate of the increased strain due to this increased weight and found it to be about 7 per cent. In conference with Mr. Szlapka at a later time he approximately confirmed my calculations in regard to the percentage of increased load and increased unit strain. Realizing that there was no remedy and that this 7 per cent was not a fatal increase, I did say to Mr. Szlapka, in effect, that we would have to submit to it.

Q. To what extent were the unit stresses increased in the anchor arm over the specified stresses?—A. When I had only the increased weight of the anchor arm for the purpose of my estimate, I estimated, as I stated, that the increased unit would be about 7 per cent. Examination of the final and total weight of the bridge as we now have it, leads me to believe that the unit strains in the anchor arm, when the bridge was completed, would not be more than about 10 per cent, the specified unit strains.

Q. Did the representatives of the Phœnix Bridge Company object either formally or informally to the increase of the main span or to the alteration of the specifications?—A. In no manner whatsoever did they indicate or express any objection to the lengthening of the span or to the alteration of the specifications.

Q. When were you first advised that the actual weights of the bridge would materially over-run those assumed in the computations, and what was the stage of the work at this time?—A. The first positive evidence that I had of the increased weight beyond the estimate was Mr. Edwards' report of the raw material of February 1, 1906, which he gave me for the two anchor arms and centre posts as 36,200,208. Practically the anchor span, tower and two panels of the cantilever arm were in place.

Q. Did you take any action after receipt of this information?—A. As I stated in a previous reply, I made an estimate of the increased strains due to this increased weight of the anchor arm, which I stated I found to be about 7 per cent. At a later date I took up with Mr. Szlapka the discussion of this increased weight. About that same date, February, 1906, Mr. Hoare applied to Szlapka, according to Mr. Szlapka's own statement to me for a new estimate of weights for the completed bridge. I took up at the same time the question of a new estimate and made a new estimate, taking the weights of the new anchor arm as the basis for the new weights, and completed this estimate. At the same time I instructed Mr. McLure, who was then at Phœnixville, to take up the same question in connection with Mr. Szlapka's assistants and report to me the result of his investigations. At a later date, which I have not recorded, but a month or two thereafter, Mr. McLure reported his figures for the work complete, excepting the suspended span, which he stated neither he nor Mr. Szlapka had yet completed. The figures compared very closely with the estimate I had obtained, which was about 65,000,000 lbs. of metal for everything, excluding the suspended span. Mr. McLure stated at that time that as near as he could make out the probable estimate as so far determined at Phœnixville, would place the weight of the suspended span at about 6,000,000 lbs. I told him that while I was not thoroughly satisfied, because the data was not yet sufficient, my approximate estimate was that it would be fully 8,000,000 lbs. I requested a copy of Mr. Szlapka's estimate, but have never obtained it. During that summer, in conference with Mr. Szlapka, I requested that he would make out a new strain sheet to suit the new dead load as obtained from the estimates so that we could determine the exact increase of unit strain upon the different individual members. I never received any such correction. When the last panels of the cantilever arm were presented for approval, appreciating that the weight of the suspended span would affect these special panels much more than any other portion of the bridge, and it was important that they should be proportioned for this increased weight of the suspended span, which to me at that time was yet unknown, I wrote Mr. Szlapka as follows:—

'September 29, 1906.

'The approval of the last panels of the cantilever arm require more consideration

than you have allowed me. Have you changed the strain sheet for the increased weight of the suspended span ?'

I am under the impression—I am depending upon my memory and may be in error—that he reported to me that he had increased those last panels for the new weight of the suspended span. That is my impression, that they were proportioned for the new weight.

Q. In your computations did you assume the dead load to be uniformly distributed or did you determine the probable concentration at the various joints in the trusses ?—A. In computing the dead load strains I was furnished by Mr. Szlapka with a diagram dated May 12, 1904, which gave the dead load concentrations for the anchor and cantilever arms, Quebec bridge. These dead load concentrations vary at every point. I asked Mr. Szlapka when this was presented to me, whether it was carefully and properly estimated. He stated that he had had his best men to carefully estimate the weight at each point and that this was a correct arrangement of the final weights to the best of his belief. As I had no other means of determining these weights, the plans not being yet submitted to me, I assumed them to be correct and used them in determining my strains. I did, however, check these weights in the following manner: I added together all the concentrated loadings, deducted the allowances for floor and timber which he states here especially, and found that the resultant weight was abundant to cover the assumed estimated weight of the structure.

Q. In your computations did you include erection stresses and did you fully satisfy yourself that all members were properly designed to carry these erection stresses as well as those arising from the specification loadings ?—A. Yes, with the loads presented to me by the Phœnix Bridge Company as covering the weight of their traveller. While I did not verify each individual erection strain, I checked them sufficiently to be convinced that they were correct for the assumed loads.

Q. You have stated that the bridge might have been saved by using one hundred dollars' worth of timber and bolts. Would you please explain how this could have been done and would you desire to amplify your former statements on this point ?—A. In my former testimony I stated that after Mr. McLure had left my office on the day of the disaster I did prepare a rough sketch which I showed Mr. Berger, of the method I would suggest to the Phœnix Bridge Company for protecting and strengthening this chord in case they proposed no better method. This sketch consisted of a rectangle composed of the two opposite chords, the two transverse struts connecting the ends of these chords and the two lateral braces diagonally across this rectangle. I drew from the centre of the crossing of the two lateral braces an additional horizontal strut extending to he centre of the chord and explained that I would put in a stiffening strut at that point connected properly to the chord, thus shortening its length as a column in its weak direction to one-half of its former length; that then we could add diagonal plates, or if safe to remove any of the lattice bars put on additional plates until we obtained a chord permanently satisfactory. I also added that if the chord was showing weakness from any mistake in design, we could strengthen all the chords throughout the bridge in the same manner, by introducing these intermediate transverse struts and thus ensure their abundant strength.

When I stated that the bridge could have been saved by the use of $100 worth of timber and bolts, I had in my mind to insert in the place of these transverse struts just mentioned a timber strut formed of about four 12 x 12's about 30 feet long, properly spaced apart, so as to make a wooden strut perfectly capable of resisting one hundred tons, which I estimated was the theoretical force to be resisted at the centre of this chord, bent as shown. Whether this would cost $100, more or less, is a matter of very small importance.

Q. Referring to your previous statements that the bridge could have been made permanently perfectly safe and efficient for its intended purpose, will you please explain what is in your mind and how you would suggest that this might have been effected ?—A. I think I have explained that in my previous answer in regard to insert-

ing permanent struts to divide the chords in half and reduce their compressive length and adding additional plates or diaphragms between the ribs of the chord if, on examination, it was found necessary.

Q. Did you consider at noon on August 29 that the collapse of the bridge was imminent?—A. I did not think at that time that without additional loading the collapse was so imminent that a remedy could not be applied; but I was not aware at that time that they were adding new material and had been for the previous day.

Q. Will you please say why when you telegraphed the Phœnix Bridge Company at noon on August 29, you did not telegraph also to the chief engineer of the Quebec Bridge Company? We understand that on a previous occasion you stopped work on the bridge by adopting this course?—A. During the half hour that I had this matter under consideration I felt that prompt action was needed to stop any more loading and to promptly protect the chord from further deflection. Learning from Mr. McLure that there was no one upon the work but the foreman, realizing that it might be very slow reaching Mr. Hoare, as he might be at his home, his office, the bridge or some other place, I decided that the shortest and quickest method of reaching the bridge was through the Phœnix Bridge Company, who, I knew, had direct wire and telephonic communication with their office at the bridge. On the previous occasion when I stopped work on the bridge by communicating with the chief engineer of the Quebec Bridge Company there was no emergency before me.

Q. You have referred to the position and condition of the big traveller as not having been reported to you. Will you be good enough to refer to your photographs and correspondence and reconsider this matter? It would appear that information with regard to the location and condition of the big traveller was in your possession prior to August 29?—A. I have refreshed my memory by reference to my photographs and correspondence.

On August 17, Mr. McLure reports:—

'The work of removing the large traveller is progressing and the tip of the top overhang has been lowered this week. The removal of weight from this traveller, however, does not nearly keep pace with the additions to the suspended span.'

On August 24, Mr. McLure reports:—

'The top forward overhang is now entirely removed from the big traveller, two engines are taken off and the lower forward overhang removed.'

I therefore was under the impression that they were continuously dismantling the large traveller. I did not give special attention to the fact that the photographs still showed some portion of the big traveller in position, because I had supposed from the understanding we had with the Phœnix Bridge Company and Mr. McLure's reports that they were dismantling the traveller as fast as possible.

Q. Were the reports of shop work and field work at any time of such a nature that you considered it necessary to stop the work or to place more competent men to represent you, and, if so, what action did you take?—A. In the first place I must protest against the idea that any of the employees of the Quebec Bridge Company represented me. That all action by them was referred to me is true and in the interest of the work I endeavoured to get the best results possible. I did reprimand Mr. Edwards very severely once or twice and I stated to him, after a repetition of some of the bad work in boring the chords that his duty was not solely to discover errors, but to prevent them; that I did not expect an inspector to merely sit down and verify work after it had been made wrong and report to me, but I expected him to know that the work was placed in the tool in the correct manner and that the tool was the proper tool to do the work required. He stated that it was a very difficult thing to do in the Phœnix Iron Company manufactory, that the workmen and the foremen resented any instructions or interference by the inspector and took the stand that the inspector's business was simply to inspect the work after it was completed and turned over to him. I told him this was not satisfactory and I wanted him to represent to the Phœnix Company that I demanded the right for the inspector to verify the setting of

and its being placed properly in the tool. He stated that there was the same objection in the Phœnix Iron Company against the interference in that manner of the inspector for the Phœnix Bridge Company. At a later date, errors still being continued, I told Mr. Edwards in my office that I would remove him and replace him if it had not been that the work was so far advanced that I felt that we had not time to break in a new inspector.

In reference to the field work I felt that Mr. McLure was doing his duty to the best of his ability and I had no reason to complain in regard to him.

Q. Were you aware that the lower chords of the anchor arm were fabricated before the weights of the suspended spans and the cantilever arms were closely computed and that the stress sheet for the anchor arm used in the design was therefore incorrect?—A. The exact weight of the suspended span and cantilever arm were not computed closely until the late dates mentioned in my previous answers, and I was not aware that the estimated weights were less than the actual weights until the work was too far advanced to make any corrections for the new stress sheet.

Q. Why did you not stop the progress of fabrication until reliable sheets were prepared?—A. For the reasons stated above.

Q. Please furnish references to the records of all full sized column tests of which you have knowledge?—A. To answer this question properly it would be necessary for me to refresh myself on all the engineering literature of the last thirty years. There will be found in the publications of the American Society of Civil Engineers a great amount of data in regard to column tests made upon full sized members. Further information will be found in the reports of tests on metals by the United States government. Some very interesting and important tests will be found in the report of Mr. Bouscaren, of the Cincinnati Southern Railroad many years ago of the earlier tests made on practical sized bridge columns. It would be impossible for me to go into this matter further; it would be simply a matter of going through the libraries and hunting up the literature.

Q. Was the design of any of the compression members tested in accordance with clause 49, Cooper's 1901 specifications and found to be satisfactory?—A. No. There is no machine or method existing by which any such tests could be made.

Q. Why were no such tests made—who had the authority to order the making of such tests and who would have had to bear the expense of them—who bore the expense of the full size tension tests?—A. The answer to the preceding question applies also to this. In regard to the expense of such tests the ordinary specification requirements state that where such tests prove the member or the detail to be satisfactory the expense is to be borne by the Quebec Bridge Company, but if the tests should prove unsatisfactory the expense is to be borne by the contractor. The Quebec Bridge Company bore the expense of all full size tests which were satisfactory with an allowance for the scrap value of the material. The Quebec Bridge Company were the only parties who had authority to order such tests and they would have had to bear the expense and it is even questionable whether for such expensive tests they could compel the contractor to perform them under the ordinary specification requirements.

Q. Did you ever request that tests in accordance with paragraph 49 should be made on compression members?—A. No.

Q. Do you consider that the requirements of paragraph 95, Cooper's specifications, 1901, influenced the design of the lower chord members and resulted in the selection of the section finally adopted in preference to anything like a box section?—A. I do not know if this clause of the specification had any influence upon the design for the lower chord members. The form of the lower chord members in general was determined by two factors, first, the desirability of a form that would not hold water and which could be always thoroughly inspected and painted, and secondly, requirements of the details necessary for the different joints in order to connect the web members with the chords and to enable spliced plates to be introduced of sufficient value. This last factor undoubtedly exerted a large influence in the general form of section selected.

Q. State clearly the substance of any communications made to you by representa-

tives of the Phœnix Bridge Company concerning the design of the lower chord members and of any discussions concerning this design?—A. I do not recall the substance of any discussion in regard to the design of the lower chord members, excepting that at one of Mr. Szlapka's visits to my office, when they were desirous of having me visit the Phœnix works to see a chord which had been especially prepared for my inspection, —after stating to Mr. Szlapka that I did not intend to go over, that that was not my method of inspection, that I preferred to see work that was not specially prepared for my inspection and did not intend to waste the time to go over and examine it,—I asked him in regard to the same and he spoke of it in high terms, made no criticism in regard to any part of it, but he said, partly laughing: 'Mr. David Reeves thinks the lattice bars should be heavier.' Mr. Szlapka made no criticism of the lattice bars, left me under the impression that he was perfectly satisfied with them and I simply made a remark to the effect that I supposed Mr. Reeves would be very glad to increase the tonnage. But no technical man connected with the Phœnix Bridge Company ever made any criticism to me, nor do I remember any suggestions referring to any changes in the form of the chords.

Q. Have you any statements to make which have not been already covered in your replies?—A. I would like to make a few observations in correction of the testimony that you have submitted to me as obtained at Phœnixville. Mr. Norris states that I wanted young men just out of college for inspectors, without any practical experience. That is not correct. I never had any such idea; I distinctly stated to every one with whom I came in contact that I desired at the shops technically educated young men with bridge experience. Mr. Deans in his testimony implies that it was my business to direct how errors should be remedied. I did suggest in my letter to him, as it was reported to me that they could not straighten a curved chord by the use of a jack, on account of scarcity of room, that by the use of long bolts the chord could be pulled into form. I declined to take the position of saying how errors of this character should be corrected, but did reserve the right to approve or disapprove the method proposed by the contractor.

He also states, in reference to the discussion between Mr. McLure and Mr. Milliken, that it was work which demanded prompt attention, and yet they had neglected it for several weeks until I drew Mr. Szlapka's attention in my office to the necessity of applying a remedy.

In the testimony of Mr. Scheidl and Mr. Szlapka the claim is made that it was always their intention to limit the thickness of the eye bars to two inches and that they endeavoured to keep the slopes down to four inches. My answer to this is to file with you a diagram (Exhibit 116) of the arrangement of the top chord submitted to me, shown on their sheet 'W,' dated May 20, 1904. This sheet 'W' showed slopes approximating seven inches and bars up to 2½ inches in thickness.

This was the original plan submitted to me for approval for the top chord of the anchor arm and was rejected by me.

They submitted another sheet or sketch—I am not positive which, it is not on record in my office—in the early part of July, 1904, which also contained bars 2½ inches thick. This plan was also rejected by me.

They finally submitted about July 27, 1904, a sheet which I found approvable. It is true that this last design of theirs did not follow the plan sent by me to them about July 1. They had done what I had suggested in my letter at that time, taken advantage of the distribution I had shown, but had improved and bettered it, maintaining the requirements that I distinctly stated at that time I aimed at, that no bars over 2 inches thick should be used anywhere except in the first or second panel and that no slopes over 4 inches should be allowed except in the first two panels and that the bars of these panels with slopes greater than 4 inches must be bored in the machine in the same position as they were to be placed in the chord.

Mr. Szlapka also speaks in condemnation of a suggestion that I made in regard to taking up the movement of the suspended span under the action of a s stopped train. In explanation of this I would state that the Phœnix Bridg

submitted a plan by which the suspended span was fixed at one cantilever arm and free to move at the other extremity. This, at a temperature range of 150 degrees, which is the usual allowance for expansion, would have necessitated an expansion joint at one point of 24 inches. I rejected this proposal and stated that this extension should be so arranged that one-half of it only should occur at each end of the suspended span, and I felt that this amount of expansion could be provided for by a special device, but I had grave doubts whether any such expansion as 24 inches could be made safe for railroad traffic. Mr. Szlapka differed from me and brought up the subject of the swinging of the suspended span under the action of a train. I made a hasty sketch showing that by a leaf friction method, using the guard rails and a few additional timbers, this motion could be easily provided for without interfering with the natural extension of the trusses. This was suggested merely as a method indicative of how this trouble could be provided for. Later on Mr. Szlapka and I discussed the making of a similar device in metal to accomplish this purpose. In addition to my objection to having an expansion joint as great as 24 inches at one point in the track which I considered a matter of absolute danger, this amount of motion necessitated the swinging of the suspender through an arc of 24 inches, an amount of motion that could not have taken place about the suspending pin without producing excessive and dangerous bendings in the suspending members. I pointed out to Mr. Szlapka that with a special device in the form of pin hole and pin 12 inches of motion could take place without sliding frictions or producing undue bending strains in the suspending member.

Q. We would like you to supplement, if you can, your reply to the last question in your previously given evidence ?—A. You ask me whether I consider that the engineering data at our disposal are sufficient to enable engineers to design members similar to those in the lower chord with safety and economy. I do. While I do not mean to deny the desirability of far greater knowledge and study experimentally of our compression members, I feel that the faults in the existing chords as shown by the results of the disaster, do indicate in what manner these chords can be made, as I believe, effective and capable of doing the work they were intended to do. I believe that if the webs of the existing chords had had greater strength at the tops and bottoms, or, in other words, larger and wider angles, and if a horizontal web at the middle of these chords had been inserted their full length, over splices and all, this web would have given these chords abundant transverse stiffness in the horizontal direction, with the present latticing alone, and at the same time would have allowed access to all parts of said chord for inspection and painting. The introduction of this intermediate web would also have stiffened and protected, to a far greater extent, the splices during their critical period. I do not mean to suggest this form of chord at the best or as the only form; this suggestion is simply indicative of how I believe these cords could have been made abundantly strong and capable of standing the expected strains.

I, Bernt Berger, engineer, of the City of New York, in the State of New York, one of the United States of America, make oath and say :

1. That I attended before the Board of Royal Commissioners appointed under the Great Seal of Canada to inquire into the causes of the collapse of the Quebec bridge, on Wednesday, Thursday, and Friday, the third, fourth and fifth days of December, 1907.

2. That the annexed five pages contain my testimony and that the answers to the questions are true.

Sworn before me in the said city of New York, this fifth day of December, 1907, by the said Bernt Berger.

Mr. BERNT BERGER'S testimony.

Q. What was your position during the period of design and construction of the Quebec Bridge?—A. Assistant engineer to Mr. Theodore Cooper.

Q. How long have you been associated with Mr. Cooper?—A. For twenty-one years.

Q. Did you assist Mr. Cooper in the examination of the designs submitted with tenders in 1899, and to what extent?—A. Yes. As Mr. Cooper's assistant I examined strain sheets and proposed portions of members for the cantilever designs submitted by the Phœnix Bridge Co. and the Keystone Bridge Co. Also of the floor system for the Phœnix Bridge Co's suspension bridge design and made calculations for the studies of the substructive plans of all designs. All sufficiently thoroughly to arrive at definite results.

Q. Were you familiar with the various amendments made in the original specification?—A. Yes.

Q. Was the structure designed in accordance with the amended specification?—A. Yes, with the exception that the limit of 24,000 lbs per sq. inch on the chords for the assumed live load increased by 50 per cent was exceeded in a few cases, as follows:

Anchor	arm,	lower	chord,	6—24,400	lbs per square inch
"		"		7—25,300	" "
"		"		8—25,460	" "
"		"		9—25,270	" "
"		"		10—25,270	" "

Q. What did you do in connection with the handling of strain sheets and what strain sheets did you check—please give details in chronological order, and did these all agree with specifications?—A. I checked the strain sheet and proportion of members of the suspended span. For the anchor arm and the cantilever arm I only checked the sections given for the members to see that they were sufficient for the strains under the specifications. To my knowledge Mr. Cooper checked these strain sheets himself.

Q. When the stress sheet for anchor arm was finally approved and construction on it had begun, were the stress sheets for the cantilever arm and suspended span in your hands, and if not where were they?—A. The stress sheet of the suspended span was approved by Mr. Cooper on March 29, 1904, also a general plan of the suspended span, showing details in a general way.

The strain sheet of the anchor arm was approved on June 30, 1904. Details of the anchor arm were examined and approved from June 1904 to Feb. 1905.

The strain sheet of the cantilever arm was approved on May 25, 1905.

Q. Was the data in your hands when the anchor arm was checked, sufficiently close to allow of the work being built correctly in accordance with the specifications? —A. I did not check the strain sheet of the anchor arm, as stated above, but am aware, as Mr. Cooper's assistant, that the data were sufficiently close.

Q. Did the weights of cantilever arm and suspended span overrun the assumed weight in designing the anchor arm?—A. Yes. This I knew from Mr. Cooper, as I had not myself tabulated the shipping weights. It was discovered long after the checking of the strain sheets.

Q. How did this difference affect unit stresses in the anchor arm and to what extent?—A. The unit stresses in the anchor arm would be increased by an increase in the weight of the cantilever arm and the suspended span, but I have made no calculations of the amount of increase.

Q. Were the unit stresses in anchor arm increased beyond the requirements of the specifications, and to what extent?—A. I have made no calculations to enable me to answer this question.

Q. What checking of details did you make?—A. I examined all detail plans of

the whole structure, except the preliminary details of a part of the floor system of the bridge, the latter plans having been received in Mr. Cooper's office when I was away on a vacation in the fall of 1903. Also excepting the packing of the eyebar chords, which Mr. Cooper attended to himself.

Q. Did you find errors in the plans, and if so, what were they and what action did you take??—A. In a general way some errors were found in the number and spacing of rivets, in net sections of riveted tension members, in number of rivets for splices and joints, in mismatching of connections, length of batten plates, and in the unnecessary use of turned bolts where rivets could be used. But the plans were very carefully worked out and the number and importance of the errors were much smaller on this work than I have usually seen in bridge work. I reported all errors I found to Mr. Cooper for action by him.

Q. Were all errors remedied on drawings before final approval ?—A. Generally, yes. It did happen that plans were approved with a note that approval was contingent on correction of some draftsman's clerical error.

Q. Did Mr. Cooper discuss with you generally on matters concerning the bridge? A. Mr. Cooper talked over a great many things with me during the progress of the work.

Q. Did Mr. Cooper discuss the details of compression members with you, particularly the lower chords and their latticing, and if so give particulars ?—A. No.

Q. Did you comment in any way on the design of the lower chords at the time, or did you fully examine their design?—A. I fully examined the details of the lower chords, but made no comment except as to web splices of the centre ribs.

Q. Did you visit the bridge during the erection?—A. I did, in August, 1906, but only as a matter of personal interest, in no way sent by Mr. Cooper to look after the work.

Q. Was the work proceeding to your satisfaction ?—A. As stated under question 18, I did not visit the bridge to look after the work.

Q. Did you inspect the fabricated material in the yards, and have you any comments to make upon the quality of the work ?—A. I visited the Phœnix Bridge Co's. works during the manufacture of the bridge material, but did not go there to inspect fabricated material, only as a matter of interest to myself.

Q. Would you say that the quality of workmanship was equal to that called for by the specifications ?—A. I had nothing to do with the inspection of the workmanship.

Further evidence was obtained from Messrs. Hoare and Kinloch.

Re-examination of Mr. E. A. HOARE, January 4, 1908.

Answers to questions asked by Mr. HOLGATE.

Q. Did the Quebec Bridge Company accept the tender of the Phœnix Bridge Company of March, 1899 ?—A. The tender was not accepted specifically, as the company was not in a position to formally accept any tender, but from Mr. Cooper's report, the selection of contractors was made, though the Phœnix Bridge Company were not notified of this in writing, but were given to understand the exact position of the Quebec Bridge Company, and also were made aware of the fact that Mr. Cooper favoured their design.

Q. Why was a price-per-pound contract entered into instead of a lump sum price?—A. It was impossible to execute a lump sum contract for the following reasons: The time limit of the proposals expired before the company was in a position to order any of the work to proceed and it was also necessary to have the option of ordering the work ahead in sections at different periods, and as the labour and metal markets would be subject to change at these periods and the work would spread

over a long period the unit price would be affected to the extent of those changes at the time each section of the work was ordered ahead, there being no complete plans and the span not being decided. Under the circumstances a lump sum agreement was impracticable, especially as the change of channel span and the fact that the drawings were not complete, rendered it impossible to make a sufficiently accurate estimate for a lump sum contract at that time. Although the proposals were on a lump sum basis this was for comparison only and for selection of general design. A unit basis in this case also prevented charges for extra quantities which would certainly have arisen out of a lump sum agreement owing to the complications that would be sure to arise. The fixed unit prices were applied to the actual weight of metal erected so there was no room for differences, or for one party to the contract taking advantage of the other.

Q. Were the prices tendered by any other parties less per pound than those tendered by the Phœnix Bridge Co. and what were these figures?—A. Yes, but unit prices were not considered. The Keystone Co's unit prices were lower, but the tenders were compared on the lump sum basis only. I have not the details of these figures of unit prices.

Q. In view of the fact that another contractor tendered at lower prices per pound, why were not new tenders asked for before letting the contract to the Phœnix Bridge Co., the weight being an unknown element?—A. Although one of the tenders showed lower unit prices, when it was compared with the Phœnix Bridge Co's plans and tenders in all essentials it was shown by Mr. Cooper that the latter was the most economical and satisfactory in every respect. They could not be used again for open competition; an adjustment of price, as far as it was affected by the cost of labor and raw metal in connection with these plans, under the circumstances, was the most satisfactory and expeditious method to adopt. The time that it would have taken to obtain new designs would have been too long, and it is doubtful if a second competition could have been obtained after the Phœnix Bridge Co's. plans had been accepted. No bridge construction company would have incurred the expense of new competitive designs in view of the above facts. New tenders were not asked because our company had no plans of their own design to submit for competition, to prepare such plans would have taken about two years with a large staff of engineers especially qualified for this particular work, which would have taken some time to organize, and the result might not in the end have been as satisfactory as that obtained from the well organized and thoroughly trained permanent staff of bridge engineers employed by the Phœnix Bridge Co. Had the company been in the position of being able to accept the tender of March 1, 1899, and order the work ahead then, that is, had they had the money available for that purpose, they could have accepted the Phœnix Bridge Co's tender and have had the bridge completed for the lump sum price stated in that tender. This is technically the position of the two companies as at March 1, 1899, but subsequent events whereby specifications were amended and span changed would have upset any contract if it had been made previous to these important changes.

Q. Was there any weight specified which the bridge should not exceed?—A. No.

Q. Were the tenders received on March 1, 1899, compared as far as cost was concerned on the lump sum total only?—A. Yes.

Q. Were these tenders all lump sum tenders?—A. Yes, the tenders did not all coincide exactly with circulars issued. The consulting engineer, however, obtained all necessary particulars and explanations of each tender and afterwards analysed and reduced them all to the same basis for comparison, finally reporting in favour of the Phœnix Bridge Company's plans and tender, the plans being the best bridge and the price the lowest.

Q. Had the lower unit prices of the Keystone Bridge Company been adopted, would the bridge have cost less?—A. Had the Keystone figures of unit prices been applied to the Phœnix design the cost of the bridge would have been very much less, but the board was impressed by Mr. Cooper's favourable report of the Quebec

Company's design and decided to follow Mr. Cooper's report, especially at that time as the Phœnix tender was a lump sum. When the contract for the superstructure was awarded to the Phœnix Company on April 12, 1900, it was on a unit price basis, as the matter of design was of first consideration, a lump sum agreement being impracticable for reasons above given, and a contract had to be concluded at an early date; and though the span was not at that date formally decided on, yet it was expected that Mr. Cooper would be favourable to the change from 1600 to 1800 feet, so that the weights figured on originally by the Phœnix company, as for a 1,600 feet span, would not agree with those for the 1,800 feet span, so there was no way except getting further lump sum tenders or making an agreement on the unit basis, and the latter course was followed, the board feeling that they were making the best possible arrangement at that time owing to all the existing conditions.

Q. Please let us have copies of the minutes of the Board of Directors, duly certified by the secretary relating to tenders and contracts between April, 1899, and April, 1900?—A. I herewith file with you the minutes of the nine meetings at which these matters were discussed. (Exhibit No. 117.)

Re-examination of Mr. E. R. KINLOCH.

Mr. Kinloch's answer to question asked by Mr. Holgate, January 4, 1908.

Q. Please read the evidence given by Alexander Beauvais as to the riveting of lower chord splices 9-10 R. and L. anchor arm, and state if this agrees with the facts as you know them, or if it differs, please give details of such points of difference?—A. On page 455 Beauvais does not state clearly what riveting was going on on the anchor arm at the time of the collapse; there were two gangs of riveters working at this time, one on 9-10 L, one on 5-6 R.

On page 456 he is mistaken as to the amount of riveting already done at the beginning of the season 1907. There had been some rivets driven in the towershell, in the shoes and on the floor system, but there had ben no riveting done on the trusses.

On page 460. In regard to the bolting of the Montreal joint I would say there were quite a few more open holes due to the addition of the repair splice plate, but the joint was more than 60 per cent bolted.

On pages 462 and 463 and referring to $\frac{7}{8}$ bolts. This refers to the two inner ribs and was on account of the camber opening. As the bridge would take its final position the holes would become better. The reason the bolts were not changed was that it would be necessary to remove the top or bottom plate to do so. I do not agree with Mr. Beauvais as to the number of $\frac{7}{8}$ bolts; am positive there were more than 22 to 25; also some $\frac{3}{4}$ bolts, the rest of the holes being filled with $\frac{7}{8}$ bolts; we always used the largest size we could get in on every joint. Mr. McLure's notes will give the camber opening at the time of first bolting up.

On page 466. It was not the case that 15 rivets were driven in the side splice plates inside ribs, but that all but 15 rivets were driven.

On page 479 and 480. Speaking of the level bracing, this refers to the lower longitudinal strut in panel 9, and was purposely left loose as per erection instructions.

In regard to Mr. Beauvais' statement about the bolting being loose, I would say no fitting gang ever pulls the work up tight enough for riveting, and no experienced riveting gang would trust any previous fitting. It is customary in heavy work of this kind for the riveters to carry a short piece of pipe which they fit over the handle of their wrench to get additional leverage.

The riveting on the anchor arm was practically completed. In regard to the trusses, all of the bottom chord was riveted except 5-6-R and L, and 9-10 L and 10-11 R and L. The bottom laterals were all riveted except the lower ends of the lateral in panel 10. All of the rest of the trusses were completely riveted. The floor system was about 50 per cent riveted. The top laterals, transverse struts, bottom struts were

fully riveted. All the longitudinal struts were riveted except the lower strut in panel 9, which was loose at one end. Diagonal T-50-5 had one joint on each still bolted. The present condition of the joint between 9 and 10 shows the ends of the ribs of both chords in good condition and in about the same distance between the ribs transversely as before. The top cover plate is attached to chord 9 and the temporary angle is in place on the bottom, showing there has been no transverse distortion. The outside west rib of chord 9 and the outside west rib of chord 10 are about 8 inches apart, the side splice plates are attached to chord 10 rib, the bolts having sheared on chord 9 rib. The west centre rib of chord 9 and the west centre rib of chord 10 are about 2 inches apart, the splice plate is riveted full and is broken square at the joint. The east centre rib chord 9 and east centre rib chord 10 are almost abutting. The splice plate is riveted full, except about 15 holes. The plate is not broken at the joint but bent. The east rib of chords 9 and 10 are abutting, and the side splice plates are attached to both chords. Taken as a whole the condition is exactly what would have to happen upon the deflection of the centre of chord 9-L towards Quebec. There is no indication of any initial failure at any place, and the only way in which I can see that it might have contributed a share to the failure would be from the fact that it did not close up like the rest of the chords, but was very slow in coming to its proper position; this may have caused the top part of the chord to have carried more than its proportion of the load even though the bottom of the ribs were in perfect contact. I have looked the chords carefully over with this idea in mind, but can find no marks that will show that any one part of the chord ends received more compression than another, but this condition of unequal bearing might have existed and yet show no marks on the end sections.

CORRESPONDENCE ORDERED TO BE INCLUDED IN EVIDENCE.

MONTREAL, January 10, 1908.

Honourable S. N. PARENT,
Ottawa, Ont.

DEAR MR. PARENT,—I would like you to state what you considered to be the real duties of Mr. Hoare and Mr. Cooper, and what you as president of the Quebec Bridge Company expected from each.

Mr. Cooper was only the consulting engineer, while Mr. Hoare was the chief engineer, yet we find Mr. Cooper performed many duties which should belong to the chief engineer. What was the reason for this, and was the board aware of what was going on ?

Had Mr. Hoare as chief engineer full control of the work, and the carrying out of the contract with the Phœnix Bridge Company ?

Who would be responsible for permitting the contractors to act contrary to the contract, keeping in mind that Mr. Cooper was never given a copy of the contract and never saw it nor was he advised of its terms, so it is clear that it was not Mr. Cooper ?

Did the board at any time authorize any one to vary the terms of the contract with the Phœnix Bridge Company, and if so what were these variations, or d board at any time vary the contract ?

Had the Department of Railways and Canals a copy of the Phœnix Bridge Company's contract ?

Was the contract with the Phœnix Bridge Company of June 19, 1903, intended to be carried out as signed and whose duty was it to see that this was done ?

Did you consider prior to 1903 and subsequently that Mr. Hoare was competent to act as chief engineer and carry out the duties and responsibilities that attach to that position, or did you consider the position of chief engineer merely a nominal one with the responsibility elsewhere, and if so on whom was this responsibility, and what was the understanding of the Board of Directors on this question ?

I would be glad if you would carefully read the above, and let me have your reply at the earliest possible date.

Sincerely yours,

H. HOLGATE.

THE COMMISSIONERS OF THE TRANSCONTINENTAL RAILWAY, OTTAWA.

OFFICE OF THE CHAIRMAN, January 11, 1908.

DEAR MR. HOLGATE,—Your letter of yesterday's date is received and I readily comply with the request it contains that I give a reply to the various questions asked therein.

While Mr. Hoare had the title of chief engineer and Mr. Cooper that merely of consulting engineer, still we considered the latter as being in fact chief engineer of the enterprise. At the time the services of Mr. Cooper were secured, he would not undertake this work unless given full control over it not only in the preparation of the plans, but also during the execution of the work. Evidence of this was given in 1906, if I remember correctly, when he telegraphed Mr. Hoare enjoining him not to accept certain pieces of material from the Phœnix Bridge Company, as must appear in the documents now before your Commission. Further proof of this is given by the fact that Mr. Hoare, although being chief engineer in name, after conferring with Mr. Birks over certain matters, did not wish to assume the responsibility of taking a decision himself and sent Mr. McClure to Mr. Cooper in New York to lay the question before him. What further confirms the view which we were holding on this point, i.e., that Mr. Cooper had absolute control of the work, is the fact that when Mr. McClure went to see him on the mission just referred to, which was on the day of the accident, instead of sending advice direct to Mr. Hoare, as would have been the proper course if the latter had been the one in authority, he Mr. Cooper despatched Mr. McClure to Phœnixville with instructions to the Phœnix Bridge Company not to put any more metal on the structure until further advice. Therefore although bearing the title of chief engineer because he had started as such with the Quebec Bridge Company, Mr. Hoare was not really in authority when it came to the general direction and control of the enterprise, these duties being left to the consulting engineer, Mr. Cooper, at his own request as already stated.

For my part, as president of the Quebec Bridge Company and knowing the arrangements made with Mr. Cooper, I always considered that the latter and not Mr. Hoare as having full control of the work, though nominally only consulting engineer, and the carrying out of the contract with the Phœnix Bridge Company for the structure. Another fact shows Mr. Cooper's stand on this point. When the government was considering the advisability of appointing Mr. Nichols, who was considered to be an experienced bridge engineer, in order to supervise more closely the execution of the work, Mr. Cooper strongly opposed the proposal on the ground that he would not leave to any other man the responsibility of the work, and that if the government should persist in that course he would resign, and that he was satisfied to have Mr. Hoare send him reports from time to time on the state of the work.

With regard to the contracts, I am not prepared to say that Mr. Cooper was never made acquainted with the terms of the same, since he saw fit to modify the first contract for the structure by changing the length of the span from 1,600 feet to 1,800, and in the second place as he had the specifications, which formed the basis and the essential part of the contract, for his guidance while the work was going on.

The documents in your hands will show the few changes which may have been made in the plans, and in the specifications. As far as I can remember, they were made by Mr. Cooper. The board relied entirely upon Mr. Cooper for the proper execution of the work. He had stated his own terms as regards salary, which were accepted. This appears on record.

To the best of my memory, the Department of Railways and Canals had a copy of the Phœnix Bridge Company's contract.

The contract speaks for itself and should answer the questions you ask regarding its carrying out.

Coming to your last question, I have answered it to some extent in the first part of this letter. While Mr. Hoare was considered a competent man to look after the work entrusted to him under these conditions, everybody was aware, at the same time, that he did not possess the experience and special qualifications of a specialist in this branch of engineering which would permit of entrusting to him the responsibility of an undertaking of this magnitude. It was for this reason that the government, realizing the importance of such expert direction, wanted to appoint a specialist on bridge engineering with the result already mentioned, as Mr. Cooper did not think that he could relinquish some of the responsibility for this enterprise on any one else. In view of this, as I understood it, Mr. Hoare was there more especially for the general supervision of the work, and, in particular, to report to Mr. Cooper from time to time as to the progress of the work and discuss with him any questions that might arise offering some difficulty.

Trusting this will cover the scope of your questions fully enough, I remain,

Yours sincerely,

S. N. PARENT,
Pres. Quebec Bridge and Railway Co.

HENRY HOLGATE, C. E.,
Prest. Royal Commission,
Quebec Bridge Inquiry.
Montreal, Que.

MONTREAL, January 3, 1908.

JOHN STERLING DEANS, Esq.,
Chief Engineer, Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR MR. DEANS,—Will you please inform me in what form was your tender of March 1, 1899, accepted by the Quebec Bridge Company. If verbal, give me the particulars, and if written let me have copies of letters.

I urgently require this information, so please let me hear as quickly as possible.

Sincerely yours,

H. HOLGATE,

THE PHŒNIX BRIDGE COMPANY.

PHILADELPHIA, PHŒNIXVILLE, NEW YORK, CHICAGO, BOSTON, LONDON, ENG.

PHŒNIXVILLE, PA., Jan. 6, 1908.

Refd. to... .. ..
Noted.. .. ..
Recd. Jan. 23, 1908.
Answd.. .. ..
File No... ... ...

HENRY HOLGATE, Esq.,
Chairman Royal Commission,
Montreal, Canada.

DEAR MR. HOLGATE,—In reply to your letter January 3, I hand you herewith copy of letter of Hon. S. N. Parent, President Quebec Bridge and Railway Company, dated August 23, 1899, which is the first formal acceptance of our proposition of March 1, 1899.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

P.S.—I just understand from Mr. David Reeves that you have a copy of this letter.—J.S.D.

THE QUEBEC BRIDGE COMPANY.

QUEBEC, August 23, 1899.

JOHN STERLING DEANS,
Chief Engineer Phœnix Bridge Co.

DEAR SIR,—Referring to yours of this day, I beg to state that this company is ready to enter into a contract with your company, for the superstructure of our proposed bridge, subject to the modifications in the specifications either decreasing or increasing or any other that may have to be made in size, depths and locations of the piers and their caissons; provided you accept in payment your share of the amount of $1,500,000 in subsidies or their equivalent and the difference in bonds given in trust as collateral security, face value and interest on same, at their redemption on conditions to be agreed upon, but at any rate the company will decide before the bridge is open for traffic to redeem the said bonds at face value or surrender them to the contractors; this company binding themselves to transfer you your proportionate share of any further subsidies or guarantees of interest that they may receive towards the construction of the said bridge. We will furnish by an early mail a statement showing the position of the company, its available subsidies and prospects as to resources and earning powers. If your company accepts the above conditions, we on the other hand will accept the conditions stated in your letter of this day, that we may order the work from you at any time within two years, providing at the time the work is ordered to proceed either party to the contract may request the prices for plain structural metal revised, to agree with the ruling prices of metal at that time and provided also that you give us to-day the price of your metal on which you have based your tender. This option is open for fifteen days from this date.

Yours truly,

S. N. PARENT,
Pres. Q. B. Co.

I, P. L. Szlapka, designing engineer of the Phœnix Bridge Company, Phœnixville, Pennsylvania, U.S.A., do hereby solemnly and sincerely declare that the document annexed hereto and marked Exhibit 'A' and numbered pages 1 to 4 is a portion of the evidence taken by the Royal Commission of Inquiry into the collapse of the Quebec Bridge and is to the best of my knowledge and belief true, and I make this solemn declaration conscientiously believing the same to be true and by virtue of the Statutory Declaration Act, 1885.

(Sgd.) P. L. SZLAPKA.

Declared and subscribed at the British Consulate, Philadelphia, this twenty-second day of January, one thousand nine hundred and eight.

Before me

(Sgd.) WILFRID POWELL,

[SEAL.] *H. B. M.'s Consul.*

This is the exhibit marked 'A' and numbered pages one to four referred to in the affidavit of P. L. Szlapka, designing engineer of the Phœnix Bridge Company of Phœnixville, Pennsylvania, U.S.A., sworn before me this twenty-second day of January, one thousand nine hundred and eight.

WILFRID POWELL,

British Consulate, Philadelphia. *H. B. M.'s Consul.*

[SEAL.]

EXHIBIT 'A.'

1. State your method of computing the latticing in the lower chords and illustrate it by making the calculation for chord 9 anchor arm. State clearly the unit stresses used in each part of the design of that chord, and give the authority for the use of those stresses.

2. Did you make separate calculations for the latticing in each chord, or if not what did you do?

3. Did you apply the same method to the lattices of all compression members?

4. Mention what records of tests upon columns were familiar to you at the date when the general form of the compression members for the Quebec bridge was decided upon?

5. State what dead loads were used in the calculation of the stresses with which the members were finally designed, and how the dead load was divided between the various panel points.

6 Give your reasons for assuming ½-inch deflection in webs of chord for designing latticing.

7. Did you in your calculation of latticing consider the compression in the lattice angles due to the general compression in webs of chord?

8. Why did you assume C=36000, which is the constant for square ended columns instead of 18000, the constant for pin ended columns—values as given on page 88 Phœnix Iron Company's pocket book of 1906.

9. What investigations with regard to the design of lattice compression members did you make before deciding upon the adoption of the method given in Johnson's Modern Framed Structures.

Mr. SZLAPKA'S testimony.

1. With a maximum permissible unit stress of 24,000 lbs. as specified by Mr. Cooper, and with a lateral deflection of ½ inch as per No. 6 below, t
method was used in calculating the size of the lattices for the lower ch

evolved from the discussion in 'Johnston's Modern Framed Structures,' the only authority to my knowledge which deals with this problem.

For anchor arm lower chord section (9) having an area of 780 square inches.
P=24,000 lbs. x 780"=18,720,000 lbs.
S=lateral deflection=½".
Moment M=9,360,000-inch lbs.
W transverse force at centre of chord to produce moment M.
L length of chord (9) 684".

$\frac{WL}{4}$=9,360,000-inch lbs. and therefore

$\frac{W}{2}$=about 27,400 lbs. and

L=stress in each of the four lattice.

$L = \frac{27,400 \times 1 \cdot 4 \text{ about}}{4} = + 9,600.$

The Quebec Bridge Company's specifications, as amended by Mr. Cooper, specified a shearing unit stress on rivets equal to three-quarters of the unit stress on the member or in this case equal to ¾ x 24,000, 18,000 lbs., therefore two ⅞ single shear rivets, having a value of 21,600 lbs. were used to carry the above stress of about 9,600 lbs. in each lattice; the strength of the latter was made equal to the two ⅞-inch rivets, only the horizontal leg of the angle being considered as acting.

2. The calculation of lattices was made only for the heaviest chord sections; the same size lattices were used for the entire lower chord, to secure uniformity of work and to guard against probable errors, if several sizes of lattices were used.

3. Yes.

4. Tests on small columns as given in the United States government 'test of material,' and as described and discussed in the current engineering papers, were known to me at the time of designing the large compression members of the Quebec bridge.

5. See attached blue print.

6. From the two equations (derived from the beam and from the compression formulæ).

$$T = \frac{MD}{2} = \frac{PSD}{21}$$

and also:

$$L_2 = \frac{PL^2}{cI}$$

we obtain:

$$\frac{SD}{2} = \frac{L^2}{c} \text{ or } S = \frac{2L^2}{cD} = \frac{2x684x684}{36000x68} = 0.\ 38''$$

which was increased to ½-inch to simplify calculations.

7. Yes, in a general way.

8. Mr. Cooper's special specifications for compression members of the Quebec bridge required no reduction of unit stresses by any compression formula for lengths less than fifty times the least radius of gyration, or in other words members not exceeding that length were to be considered short columns. The chords being continuous, *i.e.*, having no pin bearings, were considered fixed between panel points, and therefore the constant (*c*) in the compression formula was used equal to 36,000 lbs., as given on page 88 of Phœnix Iron Company's pocket book of 1906, Johnson's Modern Framed Structures, &c.

9. In the study of the question and for the purpose of designing the lattice compression members I consulted over one hundred modern standard specifications drawn

by engineers of railroad companies and by consulting engineers. I examined all the latest American engineering books, including Johnson's Modern Framed Structures, treating the theory of compression members; two standard German books upon the same subject, the current American engineering literature, some of the current German and English engineering papers, and all other authorities that were available to me.

The only discussion that I found upon the subject was in Johnson's Modern Framed Structures.

THE QUEBEC BRIDGE AND RAILWAY COMPANY,
QUEBEC, January 31, 1908.

HENRY HOLGATE, Esq., C.E.,
c/o. Ross & Holgate, Montreal.

DEAR SIR,—In reply to yours of the 29th instant, addressed to the president, I am instructed to inclose a sworn statement of the money received from the shareholders of the company in payment for stock issued, and also the amount of stock issued to each shareholder.

Hoping the whole will be found satisfactory, I remain,

Respectfully yours.

ULRIC BARTHE,
Secretary.

LIST OF SHAREHOLDERS OF THE QUEBEC BRIDGE AND RAILWAY CO.

10. Holders of first stock subscribed prior to 19th October, 1903 (as it appears to date 31st January, 1908, in the stock ledger of the company)—$63,700.

	Number of Shares paid up.	Amount
Allard, J. B. E.	¼	$ 25 00
Amyot, Joseph	2	200 00
Amyot, G. E.	½	50 00
Amyot, G. E.	3¾	375 00
Anctil, Joseph	¼	25 00
Asselin, N. H.	¼	25 00
Audette, Dlle Albertine	1	100 00
Audette, Dlle H.	1	100 00
Audette, Dlle L.	1	100 00
Audette, Dlle R. M.	1	100 00
Audette, L. Gustave	4¼	425 00
Audette, Rodolphe	53	5,300 00
Baillargeon, Mme. G. A.	1	100 00
Beau, Dlle R. J.	¼	25 00
Bedard, E.	1¼	125 00
Bedard, J. B. & Frere	½	50 00
Bedard, Jos. E.	1¼	125 00
Bedard, L. O. (Succ.)	½	50 00

LIST OF SHAREHOLDERS—*Continued.*

	Number of Shares paid up.	Amount.
Beemer, H. J. (by notorial deed transferred to Senator P. A. Choquette)	35	3,500 00
Belanger, A.	¼	25 00
Belzil, Ls. G.	¼	25 00
Berlinguet, F. X.	2	200 00
Bilodeau, I.	1¼	125 00
Blais, Wilbrod	1¼	125 00
Boswell, V.	47	4,700 00
Boulanges, Dame A. A.	1	100 00
Breakey, John	29	2,900 00
Burn, Henriette D.	3	300 00
Cantin, I. D.	¼	25 00
Cantin, V.	¼	25 00
Carrel, Frank	¼	25 00
Casgrain, Edm.	2½	250 00
Chabot, L. G.	¼	25 00
Chateauvert, Geo.	¼	25 00
Chateauvert, V.	1	100 00
Chauveau, Alex. J.	1¼	125 00
Choquette, Hon. P. A.	½	50 00
Clement, F. X. M.	¼	25 00
Cloutier, Ephrem (Succ.)	1¼	125 00
Consigny, N.	½	50 00
Côté, Achille	¼	25 00
Côté, Edouard	¼	25 00
Côté, Joseph	¼	25 00
Côté, J. B.	¼	25 00
Côté, P. J.	1¼	125 00
Crepault, Z. (Succ.)	2½	250 00
Darveau, Geo.	2½	250 00
Delage, Cyrille F.	1¼	125 00
Demers, L. J. (Succ.)	1¼	125 00
Derome, H.	¾	75 00
Dery, Arthur	¼	25 00
De St. Georges, H. Q.	¼	25 00
Dobell, Mrs. E. F.	28	2,800 00
Dorvall, Eugène	¼	25 00
Doyle, Wm.	¾	75 00
Drolet, Arthur	1	100 00
Drolet, D. E.	1¼	125 00
Drouin, Napoléon	2½	250 00
Dumoulin, P. B. (in trust)	5¾	575 00
Dupuis, A. B.	2½	250 00
Duquet, Cyrille	¼	25 00
Dussault, Nap. (Succ.)	¼	25 00
Faguy, Lepinay & Frere	2½	250 00
Faguy, Revd. F. X.	¼	25 00
Fortier, F. G.	1	100 00
Fortier, Nazaire	2½	250 00
Fournier, Auguste	2½	250 00

LIST OF SHAREHOLDERS—*Continued.*

	Number of Shares paid up.	Amount.
Garneau, Hon. N.	47¾	4,775 00
Gauthier & Frere (Cie)	5	500 00
Gauvreau, F. E.	¼	25 00
Gignac, J. H.	1¼	125 00
Girard, A.	2¼	225 00
Guay, J. F.	¼	25 00
Guerard, Malvina P.	¼	25 00
Hamel, Dr. A. C.	1	100 00
Huot, Emmanuel (Succ.)	¼	25 00
Jacot, Emile (Succ.)	¼	25 00
Jacques, Oct.	1¼	125 00
Kirouac, F. (Succ.)	5	500 00
Lafrance, C. J. L.	½	50 00
Laliberte, Edmond	1¼	125 00
Laliberte, J. B.	25	2,500 00
Langlais, J. A. (Succ.)	¼	25 00
Larochelle, J. H.	2½	250 00
Lavoie, Napoléon	35½	3,550 00
Leclerc & Roy	½	50 00
Legere, J. B. D.	¼	25 00
Lemieux, J. F.	¼	25 00
Lemieux, Mrs. E. S.	¼	25 00
Lemieux, N. & Fils	2½	250 00
LeMoine, G.	47	4,700 00
Letellier, A. (Succ.)	1¼	125 00
Letellier, Mme. S.	1	100 00
Levasseur, Nazaire	¼	25 00
Madden, Geo.	1¼	125 00
Magnan, C. J.	¼	25 00
Malouin, Hon. Albert	½	50 00
Marcoux, L. C.	1¼	125 00
Marois, F. X.	¼	25 00
Marsh, Wm. A.	2½	250 00
Martineau, J. E.	2½	250 00
Matte, J. S.	¾	75 00
McCall, Shehyn & Co.	2½	250 00
McWilliam, Wm.	½	50 00
Michaud, Ben.	½	50 00
Migner, Thomas	¼	25 00
Moisan, J. A.	¼	25 00
Moisan, L. A.	¼	25 00
Morin, L. D.	¼	25 00
Morisset, C. L. A.	¼	25 00
Morrissette, J. B.	2½	250 00
Myrand & Pouliot	½	50 00
Noel, J. M.	½	50 00
Noreau, Charles	¼	25 00
Pampalon, T. (Succ.)	¼	25 00
Paquet, Cie Ltée	30½	3,050 00
Paradis, Etienne	2½	250 00

LIST OF SHAREHOLDERS—*Continued.*

	Number of Shares paid up.	Amount.
Paradia, V. E.	1¼	125 00
Parent, Alexis	½	50 00
Parent, Chs. A.	2½	250 00
Parent, François	1¼	125 00
Parent, Geo.	6¼	625 00
Parent, J. Alberic	3	300 00
Parent, P. I.	½	50 00
Parent, Hon. S. N.	45	4,500 00
Pettigrew, Charles	½	50 00
Picard, Joseph	¼	25 00
Picard, O. (Succ.)	1¼	125 00
Picard, S.	¼	25 00
Pichette, Elz. (Succ.)	¼	25 00
Powell, C. S.	¼	25 00
Price, H. M	48	4,800 00
Proulx, Mme. R. A.	1	100 00
Rhodes, Wm. (Estate)	1	100 00
Robitaille, Hon. A.	1¼	125 00
Rouleau, Revd. T. G.	¼	25 00
Roumilhac, Edouard	¼	25 00
Ross, John T.	2½	250 00
St. Pierre, Ernest	2½	250 00
Samson, Joseph	1½	150 00
Savard, Elzear	2	200 00
Savoie, F. T.	½	50 00
Scott, B. A.	2½	250 00
Scott, J. G.	2½	250 00
Syndicat de Quebec	2½	250 00
Tanguay, Geo.	1¼	125 00
Tanguay, G. E.	2	200 00
Turcotte, J. B. O.	¼	25 00
Turcotte, Nazaire & Cie.	2½	250 00
Turgeon, P. L.	1¼	125 00
Villeneuve, L. O.	¼	25 00
Voyer, Jean (Succ.)	¼	25 00.
Walsh, John E.	¼	25 00
Total	637	$ 63,700 00
Old grant from government ,province of Quebec		$1,681 69
Forfeited payments		204 01
Capital stock account as per ledger		$ 65,585 70

SESSIONAL PAPER No. 154

LIST OF SHAREHOLDERS OF THE QUEBEC BRIDGE AND RAILWAY CO.

20. Holders of additional stock subscribed as mentioned in Statute III., Edward VII., chapter 54. (As it appears to date, 31st January, 1908, in the stock ledger of the company), $200,000.

	Number of Shares paid up.	Amount.
Allan, Hugh A.	250	$ 25,000 00
Audette, R.	4	400 00
Boswell, V.	3	300 00
Breakey, J.	2	200 00
Davis, M. P.	949	94,900 00
Fortier, F. G.	1	100 00
Garneau, Hon. N.	3	300 00
Hays, Chas. M. (in trust)	250	25,000 00
Laliberte, J. B.	2	200 00
Lavoie, N.	4	400 00
LeMoine, G.	3	300 00
Parent, Hon. S. N.	25	2,500 00
Price, H. M.	4	400 00
Quebec Central Railway	174	17,400 00
Sharples, Hon. J.	276	27,600 00
Walsh, J. H.	50	5,000 00
	2,000	$ 200,000 00

I, J. Henri Paquet, Treasurer of the Quebec Bridge and Railway Company, do solemnly declare that all names appearing on the above list as shareholders of the company are correct according to the stock ledger; that all such shareholders have fully paid up their stock; that no allotment of stock was allowed to any of the shareholders; and that some directors have purchased some of the above stock out of the money voted them as attendance fees by the shareholders at the annual general meetings.

J. H. PAQUET,
Treasurer.

SWORN before me at Quebec, in the Province of Quebec, this 31st day of January, 1908.

J. A. PARADIS,
Com. Sup. Court, District of Quebec.

CORRESPONDENCE ORDERED TO BE INCLUDED AS EVIDENCE—FURTHER QUESTIONS SUBMITTED TO MR. KINLOCH, AND HIS WRITTEN ANSWERS THERETO.

Q. Did the field joint of lower chord A-9-L in panel 9 show any indication of being butted more tightly on the west side than on the east side, or *vice versa*, when ready for riveting up ?—A. Joint of lower chord in left truss panel 9 was riveted early in June, 1907. All ribs of 9-L and 8-L butted tight. I can remember no facts that would lead me to believe any one rib was butted tighter than another.

Q. Were there any difficulties in the way of making this examination ? How did you make it ?—A. The bottom plate was removed and the examination was made from the bottom ; first, by trying to insert a very thin piece of steel between the abutting web plates ; second, by looking up between the two inner ribs and making as close an examination as possible from the top. 1st. By making as close an examination as possible and trying to enter a thin piece of steel at the top of the vertical leg of the top flange angle of the chord just above the outside side splice plate of the outside ribs of chords only. No satisfactory examination could be made of the top of the centre ribs and if all the other points were butted perfectly we assumed that the two centre ribs must necessarily be butting also at the top.

Q. Give what information you can in this respect in the case of any other field joints in lower chords ?—A. When the chords of the anchor arm were set on the camber blocks and for some time after, there was some difference in the distance between the different ribs. I believe a record will be found of this matter in Mr. McLure's notes.

Q. At the request of Mr. Hoare, Mr. Birks examined chord 9-L, anchor arm, and the field splices connecting it to the adjoining chords on August 28th and subsequently reported some results of his examination to the Phœnix Bridge Company by letter. Did you accompany him on this examination ?—A. No, but I met him just after he had finished making it and at his request I went down on to the chord and examined the field splice between chords 8-L and 9-L, he remaining at track level immediately above me and conversing with me during my examination.

Q. Did you agree that the deflection of 1½ inches at field splice shown on Mr. Birks' sketch existed and in what way was it measured. Do you consider that this deflection was present at the joint when it was riveted up in June, 1907 ?—A. We agreed at the time that there was an apparent deflection of about one-half inch at the field splice, and I do not know why Mr. Birks reported 1½ inches. Neither he nor I had any appliances for measuring the deflection, and it was estimated by sighting along the edge of the outside upper angle from about the second point of lattice attachment on chord 9-L. The estimates at best were of very uncertain value. I am confident that the joint was straight to all intents and purposes when it was riveted up, and am not prepared to say now that the deflection that seemed to me to exist on August 28th may not have been caused by the absence of any definite and well-marked line from which to measure. I noted on August 28th particularly that the lines of rivets in the upper cover plate were straight, that the rivets showed no sign of shear and that the edge of the cover plate matched the edge of the flange angles of the outside ribs on both sides throughout its length.

EXHIBITS

ORDERED TO BE PRINTED

AND

CHRONOLOGICAL INDEX

(PAGE 448)

TO

PRINTED CORRESPONDENCE RELATING TO THE BRIDGE

INDEX OF EXHIBITS.

1. Statutes and By-laws of Quebec Bridge Company.
2. Approval by Railway Committee of general plan showing location of piers at Chaudiere site.
3. General plan approved in 2.
4. Minute of Board of Quebec Bridge Company relating to the calling for tenders.
5. Approval by Deputy Minister of Specifications on which tenders were called for.
6. Circular letter calling for tenders.
7. Specification for a suspension bridge.
8. Tender received from the Phœnix Bridge Company.
9. Report of Mr. Theodore Cooper on tenders for substructure and superstructure. *(Printed.)*
10. Resolution of Board of Quebec Bridge Company to send Mr. Cooper's report, tenders and plans to the Prime Minister.
11. Report from Mr. Theodore Copper on modifications. *(Printed.)*
12. Subsidy agreement and specifications.
13-14. Contracts for the two approach spans between Quebec and Phœnix Companies.
15. Resolution of Board of Quebec Company approving 13 and 14.
16. Contract (19 June, 1903) between the companies for construction of superstructure.
17. Order-in-Council (21 July, 1902) authorizing Mr. Cooper to modify plans and specifications.
18. Order in Council (15 August, 1903) with respect to powers and duties of Chief Engineer. *(Printed.)*
19. Copies of all annual reports of Quebec Bridge Company.
20. Resolutions of Board of Directors defining position of Mr. Cooper.
21. Copy of specifications attached to contract and copy of amendments to specifications afterwards inserted.
22. Letter from Mr. Hoare to Mr. Holgate defining duties of inspectors.
23. Correspondence between Quebec Bridge Company and Mr. Cooper.
24. List of employees Phœnix Bridge Company on south side.
25. Sketch plan showing position of objects and witnesses with relation to bridge.

26. White print of Bridge.

27. Sketches made by Mr. Haley to illustrate his evidence.

28. Reports of tests, submitted by Mr. Hoare.

29. Photograph.

30. Book of plans produced by Mr. Milliken.

31. Book of plans produced by Mr. Milliken.

32. Plan showing state of progress on August 29.

33. A, B, C, folios of plans of bridge and strain sheets put in by Mr. Hoare.

33. D Index to approved plans.

34. Two books of photographs (Mr. Cudworth.)

35. Photographs (Mr. Kinloch.)

36. Agreement, province of Quebec and Quebec Bridge Company.

37. Agreement, City of Quebec and Quebec Bridge Co.

38. Record of errors found in the field (Mr. McLure) small book.

39 Record of unfinished work (Mr. McLure) (book).

40. Sketch of 'crimp' (24 inch pin.)

41. Anchor and Cantilever Arm chord sections.

42. Progress estimates and reports (Mr. Hoare).

43. Field Engineering Reports.

44. Blue print, positions top chord panel points before and after the accident.

45. Same as 44 *re* bottom chord.

46. Positions panel points east truss of anchor arm.

47. Same as 46 west truss anchor arm.

48. Measurements for horizontal movement between anchor pier and main pier.

49. Position of pedestals on main pier before and after accident.

50 Elevations of two bench marks on face of main pier.

51. Telegrams from Mr. Hoare and Mr. Deans and sketch showing bend in chord A 9-L.

53. Mr. Hoare's Diary.

54. Blue print showing location of lower chords in wreck, and description.

55. Memorandum showing deflections under wind stress.

56 Anemometer records.

57. Sketch by Mr. Kinloch showing space blocking at chord A 4-L.

58. Letters from Mr. Birks and Mr. Yenser to Mr. Deans.

59. Letter from Mr. Deans to Mr. Yenser.

60. Blue print note book entitled: 'Notes for erecting Quebec Bridge,' and blue print notes covering erection of main traveller actually used by Mr. Birks, erection engineer.

61. Statement of condition of riveting on August 29.

62. Sketch showing method used in measuring between anchor pier and main pier south anchor arm, September 17th, 1907; plan showing location of 24-inch pins, September 27, 1905; photograph showing progress of erection at close of season 1908.

63. Letter of Mr. Douglas *re* suggested amendments, and other documents.

64. Copy of Guarantee Agreements, October 19, 1903 (3 Edward 7, Cap. 54.)

65. Letter of Mr. Schreiber to Mr. Fielding, August 12, 1903, *re* modifications of specifications.

66. Copy of Railway Department's instructions to Mr. Tomney, inspector at Phœnixville, August 4, 1904.

67. Notes by Mr. Douglas on large span bridges and proposed changes in specification.

69. Copy of Telegram, August 29th, 1907—Theodore Cooper to Phœnix Bridge Company.

70. Correspondence from Mr. Cooper's letter-books. (*Printed.*)

71. Correspondence from Mr. Cooper's letter-books. (*Printed.*)

72. Correspondence from Mr. Cooper's letter-books. (*Printed.*)

73. Correspondence from Mr. Cooper's letter-books. (*Printed.*)

74. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

75. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

76. Correspondence from Phœnix Bridge Company's letter-books (*Printed.*)

77. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

78. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

79. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

80. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

81. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

82. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

83. Correspondence from Phœnix Bridge Company's letter-books. (*Printed.*)

84. Inspector Edwards' Report, 'Shop Errors.'

85. Tension tests of built-up members. (Blue print.)

86. Eye-bar tests.

87. Letter from Mr. Parent to Phœnix Bridge Company, August 23, 1899, tendering contract.

88. General outline plan Phœnix Bridge Company, November 30, 1897.

89. General outline plan Phœnix Bridge Company, November 30, 1897.

90. Daily record of Inspection Phœnix Bridge Company.

91. Record of Field corrections.
92. Statement weight removed and added Cantilever Arm in 1907.
93. Reports, condition of joints November 6, and August 29, 1907.
94. Preliminary plan No. 1.
95. Preliminary plan No. 2.
96. Plan submitted with 1,600 feet tender in 1899.
97. Stress diagrams for 1,600 feet design.
98 and 109. Strain sheets for detail design.
99. Copy of Quebec Bridge Company's specification (same as 11.)
100. Copy of modifications in specifications. (Same as 18.)
101 and 102. Mr. Cooper's specifications for workmanship.
103. Dead load concentrations Anchor Arm.
104. Stress sheet showing dead leads from actual shipping weights.
105. Stress sheet showing stresses immediately before accident.
105. A diagram showing camber movements.
106. Mr. Szlapka's personal diary.
107. Sketches of travellers.
108. Erection stresses due to large travellers.
109. Same as 98.
110. Mr. Cooper's packing of Anchor Arm top chord bars.
111. Stress sheet of Anchor Arm for 6,000 lbs. per lin. ft.
112. Instructions to Mr. Cooper to report on tenders. (*Printed.*)
113. Numbered letters giving effect to contract.
114. Statement of all payments to Mr. Cooper, Quebec Bridge Company. (*Printed.*)
115. Telegram from Mr. Cooper *re* C.P.I.
116. Sheet 'W,' May 20, 1904, Phœnix Bridge Company, top chord packing.
117. Minutes of Meetings, Quebec Bridge Company Board.
118. Original of Mr. Szlapka's concluding evidence.
119. Copy of letters patent, Phœnix Bridge Company.
120. Original letter of Mr. Barthe with list of shareholders Quebec Bridge Company.
121. Mr. Cooper's Report on change of span, May 1, 1900.
122. Mr. Ami's Report on geology of foundations. (*Printed.*)
123. Balance sheet Quebec Bridge Company, 1907, and list of directors.
124. Photos of wreck taken by Mr. Francis. (*Printed.*)
125. List of plans of bridge with important dates. (*Printed.*)
126. Photographs of details and erection methods. (Appendix 10.) (*Printed.*)
127. Photographs of details and erection methods. (Appendix 10.) (*Printed.*)
128. Meteorological Records, Quebec.
129. Copies of correspondence relating to bent chords.

EXHIBIT No. 9.

THEODORE COOPER,
CONSULTING ENGINEER,
35 BROADWAY, NEW YORK.

REPORT UPON THE COMPETITIVE PLANS AND PROPOSALS FOR THE CONSTRUCTION OF THE QUEBEC BRIDGE.

The following plans with the accompanying proposals have been submitted to me for examination and report as to their relative merits and values, viz:—

Two plans by the Dominion Bridge Company of Montreal, one for a cantilever bridge with a channel span of 1,600 feet, and one for a stiffened suspension bridge with a channel span of 2,000 feet.

One plan by the Keystone Bridge Company of Pittsburg, for a cantilever bridge with a channel span of 1,600 feet (being identical with the plan proposed by the Dominion Bridge Company.)

Two plans by the Phœnix Bridge Company of Phœnixville, Pa.; one for a cantilever bridge with a channel span of 1,600 feet, and one for a stiffened suspension bridge with a channel span of 1,800 feet.

One plan by the Union Bridge Company of New York, for a stiffened suspension bridge with a channel span of 1,800 feet.

Making in all three different suspension bridge designs and two different cantilever bridge designs.

GENERAL DESCRIPTION OF PLANS.

1st. Suspension Bridges.

Dominion Bridge Company's plan, Channel span 2,000 feet.—This plan, prepared by the Pencoyd Bridge Company of Philadelphia, is a suspension bridge with continuous stiffening trusses extending from tower to tower, this portion of the cables only carrying any load. These stiffening trusses are riveted lattice girders, 70 feet in depth. The cables dip $\frac{1}{10}$th of the span, or 200 feet. The towers are carried on sixteen cylindrical piers, eight to each tower. There are four cables, carried at the tops of the towers on movable saddles. Both anchorages are supposed to be in natural rock, and have tunnels for drainage and for access to inspect and care for the exposed metal. The spans between the shores and towers are entirely independent of the cables. The plan is accompanied by strain sheets and detail drawings.

Phœnix Bridge Company's plan, Channel span 1,800 feet.—This plan prepared by Mr. G. Lindenthal, C.E., is a suspension bridge stiffened by trussing the cables. Both the end and middle spans are loaded, so the cables carry the whole load from shore to shore; all the spans are similarly stiffened. The stiffening trusses have the cables for the upper members and the lower members are rigid chords of plates and angles. The vertical members are also rigid, but the diagonals are all adjustable wire ropes. All parts are positively connected by means of pins, the cables even being formed of wire links connected together at the panel points by pins. The whole truss thus formed is supported on pins at the tops of the towers. The towers are formed of two legs, each resting on a separate cylindrical pier 30 feet in diameter at the top. The tower pivots at the bottom on a large pin. The bridge has a buckle-plate floor which serves as a part of the wind truss. There is a toggle device at each tower which is intended to

maintain the continuity of the wind truss from shore to shore and still permit changes of length by contraction or expansion from temperature. The anchorages are supposed to be in natural rock, and after being placed, to be completely imbedded in concrete. This plan is accompanied by strain sheets and carefully worked out details, illustrating the essential features of the design.

Union Bridge Company's plan, Channel span 1,800 feet.—This plan is for a suspension bridge stiffened by trusses hinged at the ends and at the centre of the middle span, which is the only part of the structure carried by the cables; the backstays carrying no load. There are four cables and two hinged stiffening trusses. Each tower is carried on four cylindrical piers, 19 feet in diameter at the top. At the level of the roadways there extend from the towers horizontal outriggers, about the ends of which the wind cables are stretched. The structure between the shores and the towers is composed of independent viaduct spans. The plan submitted is merely a skeleton without other dimensions than the lengths of the spans and the elevations of the masonry piers. Copies of the plans of the proposed Hudson river bridge are submitted to indicate the character of the end and central hinges and other details. The plan is not accompanied by any strain sheets, sizes of parts nor any foundation plans.

2nd. Cantilever Bridges.

Keystone Bridge Company's plan, Channel span 1,600 feet.—This plan provides for two rivers arms each 550 feet long, two anchor arms each 500 feet long and a suspended centre span of 500 feet, making the channel span 1,600 feet, and the total length between anchorages 2,600 feet. The trusses are spaced 71 feet apart, centre to centre. The suspended span is 90 feet in depth and has parallel chords. The cantilever arms are 250 feet deep at the towers; the top chords sloping each way on straight lines. The floor beams are partially carried by suspenders to overhead transverse girders. The plans are accompanied by strain sheets and plans of foundations. The foundation plans are by the Engineering Contract Company of New York.

Dominion Bridge Company's plan.—This plan is identically the same as that of the Keystone Bridge Company. The foundation plans are by W. Davis & Sons of Canada.

Phœnix Bridge Company's plan, Channel span 1,600 feet.—This plan has two river arms each 500 feet long, two anchor arms each 500 feet long and a suspended centre span of 600 feet, making a channel span of 1,600 feet and a total length between anchorages of 2,600 feet. The trusses are spaced 67 feet centre to centre. The suspended span is 84 feet in depth at the ends and 120 feet at the centre, with a curved top chord, the cantilever arms are 295½ feet deep at the towers, the top chords descending in each direction on curved lines. The plans are accompanied by strain sheets and plans of foundations. The foundation plans are by the Engineering Contract Company of New York and are similar to those accompanying the proposal of the Keystone Bridge Company.

CONSIDERATION OF THE PLANS AND PROPOSALS.

After a preliminary examination and study of the several plans I made appointments with the designers of each plan (except the Pencoyd Bridge Company) and discussed with each their own design and its special features. On account of the high tender accompanying the suspension bridge plan prepared by the Pencoyd Bridge Company and the qualification made by the Dominion Bridge Company in reference to the construction of the cables, I did not consider it necessary to make any special examination of this plan.

The plan of the Union Bridge Company is indefinite and incomplete in that it

does not give the sizes of parts or proper data to determine the relative value of the design. It is not in accordance with the specifications, as it is proposed to use a higher grade of wire and of structural steel than is called for by the specifications and to strain these materials 40 to 50 per cent higher than is specified. The saving of metal by this means does not indicate any merit due to the plan and if it is permissible for one competitor to make such changes in the requirements of the specifications, fairness to the others would require that they be allowed the same privilege. The use of four cylinders for the foundation of each tower does not appear desirable in a river like the St. Lawrence, with its heavy and severe ice conditions.

The suspension bridge plan submitted by the Phœnix Bridge Company has been worked out much more thoroughly than the other suspension bridge designs. The lines of the structure are very pleasing, giving a combined effect of grace and strength. The catenary curves of the cables are not crossed or broken by the stiffening trusses. The design appears from an ordinary examination to be in accordance with the requirements of the specifications. Actual verification of the strain sheets would be difficult and require much time. A stiffening truss of the kind here proposed could not be used successfully for bridges formed with continuous wire cables, as the connections of the various members of the truss would have to be made through the frictional grip of cable bands, which would not be trustworthy. The success of such a truss depends therefore upon the use of wire links for the cables and a positive connection of all the members by means of pins. That such links can be made is undoubted, but their successful and economic manufacture has yet to be developed. The accessibility of these links for inspection at any time and the possibility, should it be necessary, of removing and replacing a link, gives this form of cable many advantages over the solid bound continuous wire cables.

CANTILEVER PLANS.

The preliminary examination of the several plans submitted led me to believe that the cantilever designs were probably the most favourable ones, in consideration of their lower tenders. They were therefore much more critically considered, not only to determine whether they were in compliance with the specifications, but also to obtain their relative values. It was then found that the two superstructure plans, viz., the Keystone and the Phœnix plans, were not proportionate for the carrying capacity. Through some misunderstanding of the specifications, the Keystone plan was proportioned for a live load two thousand pounds more per running foot of bridge than any of the other plans. In order, therefore, that this plan might be placed on a fair basis of comparison with the others, I requested the Keystone Bridge Company to correct their strain sheets and to make the corresponding change in their tender. This correction has been made and filed with the secretary of the Quebec Bridge Company and a copy has been furnished me. I have made an independent estimate of this correction, closely confirming the figures given by the Keystone Bridge Company.

Both the Keystone and the Phœnix plans of cantilever superstructure are in accordance with the specifications and are acceptable designs. The greater depth of the Phœnix design and the curving of the top members of the cantilever arms give this plan a more pleasing effect than is produced by the lower depth and straight chords of the Keystone plan. The method of carrying the floor in the Phœnix design, viz., directly to the trusses without intermediate supports, is more satisfactory than the one adopted in the Keystone plan; it also appears to be more economical, not only in weight of metal, but in saving four feet in the length of the piers. The Phœnix plan contains eye-bars of 16-inch widths, a size exceeding any heretofore made. While there is no question of the possibility of making bars of this size, it is not certain that such bars would give the desired strength and other physical qualities. There would be no difficulty, however, in substituting other forms if found desirable.

FOUNDATIONS AND PIERS FOR THE CANTILEVER PLANS.

The Engineering Contract Company furnishes similar plans for the caissons and piers for both the Keystone and Phœnix designs. The main or channel piers are alike in all of their dimensions except in the length of the piers and caissons, which are four feet longer in the Keystone plan, owing to the greater width between the trusses of this plan than in the Phœnix plan.

The piers are 24 feet wide under the coping and batter 1 in 12. The caissons are 49 feet wide for the north pier and 51 feet for the south pier; they are respectively 153 and 155 feet long for the Keystone plan and four feet shorter on the Phœnix plan.

The two Keystone piers and caissons have a total contents of 55,755 cubic yards, with a bearing area on the bottom of 15,400 square feet and exert upon the bottom an average pressure of 6.74 gross tons per square foot if allowance is made for the buoyancy of the water, or 8.5 tons if the buoyancy is neglected.

The two Phœnix piers and caissons have a total contents of 54,090 cubic yards, with a bearing area on the bottom of 15,000 square feet and exert upon the bottom an average pressure of 6.47 gross tons per square foot if allowance is made for the buoyancy of the water, or 8.22 tons if the buoyancy is neglected.

The anchorage piers and the masonry of the approaches are alike in all manners, except where necessary differences are required by the lengths of the approach spans and extra width of the Keystone plan.

In order to make these two plans, namely, the Keystone and the Phœnix, fairly comparable they should be modified so that the bearing pressures upon the bottom should be the same per square foot. Assuming the bearing pressure of 6.47 tons of the Phœnix plan as a reference, we must increase the contents of the Keystone piers about 1,300 cubic yards, making their total contents 57,055 cubic yards. This is due to the greater weight of the Keystone superstructure, even after the correction is made in its weight by changing the assumed live load.

In the above I have taken the plans with wooden caissons, as these have the most base area and are therefore the best plans.

W. Davis & Sons furnish plans for the piers and foundations for the superstructure of the Dominion Bridge Company.

The channel piers are 25 feet wide under the coping and batters 1 in 12. The bottom of the caisson is 57.5 feet wide by 156 feet long. The piers have a total contents of 58,685 cubic yards, with a bearing area of 17,887 square feet and exert upon the bottom a pressure of 5.89 gross tons per square foot if allowance is made for the buoyancy of the water, or 7.53 tons if the buoyancy is neglected.

The plans for the anchorages and approach piers differ in shape and class of masonry from those shown on the plans of the other bidders.

Messrs. Davis & Sons claim that these plans were prepared to meet the views of the Pencoyd Bridge Company, and that they hastily had to adapt the plans for the Dominion superstructure upon the Pencoyd Company declining to put in a tender. They also claim that they provided through courses of granite at the request of the Pencoyd Company and also carried their granite facing some ten feet lower than the other bidders. They therefore claim that in reducing their piers to a fair comparison with the others they should be allowed to reduce their piers to the same loads and pressures as the other bidders, and also change their unit prices to the same classes of masonry.

Considering these claims, under the circumstances, to be proper, I requested them to modify their plans and proposals on the following basis:—

To make their channel piers 24 feet under the coping; to proportionate the piers to the same loads and bearing pressures as the Phœnix plan, which I have used as the reference; and to omit the extra granite in their first plan, and to modify their tender accordingly.

They have accordingly furnished modified plans and proposals. The channel piers have a total contents of 52,400 cubic yards, with a bearing area of 14,500 square feet

and exert upon the bottom a pressure of 6.50 gross tons per square foot if the buoyancy of the water is allowed for, or 8.35 tons if the buoyancy is not considered.

They estimate the quantities of masonry in the abutments much higher than the other bidders, and also give it a higher unit value on account of the rock excavation necessary to secure a good foundation. From the information given me as to the character of the ground, I think Messrs. Davis & Sons are nearer correct than the other bids.

Omitting the abutments from both bids, the total prices for all the other piers and anchorages upon the basis of the Phœnix superstructure are as follows:—

Engineering Contract Company	$1,113,857
Wm. Davis & Sons	1,144,090

The unit prices of these two bidders, while differing, are fair competitive prices.

As the plans for the piers and foundations furnished by the above bidders are only general in character and may, or rather I should say, will need modifications to adapt them to local conditions, which may affect the relative values of the two plans, I make no recommendation in favour of either party.

RELATIVE MERIT AND VALUE OF THE PLANS AND PROPOSALS.

First.—The suspension bridge plan of the Dominion Bridge Company may be dismissed from further consideration by the relatively high tender, and also from the incompleteness of the proposal, due to the qualification made in reference to the construction of the cables.

Second.—The suspension bridge plan of the Union Bridge Company is excluded from further consideration by the indefiniteness and incompleteness of the tender, and also because the plan is not in accordance with the specifications.

Third.—The suspension bridge plan of the Phœnix Bridge Company is excluded from the fact that the tender is $600,000 higher than the tender of the same company for its cantilever plan.

Cantilever Plans.

As each of the companies submitting cantilever plans assume that separate contracts will be made for the substructure and for the superstructure, the Quebec Bridge Company should have the right to select the most favourable superstructure plan and the most favourable substructure plan independently. The proposals for the superstructure will therefore be considered separately.

Fourth.—Relative value of the proposals of the Dominion and Keystone Bridge Companies for the same superstructure plans.

The revised tenders of these companies, exclusive of all custom duties, are as follows:—

Dominion Bridge Company	$2,590,000
Keystone Bridge Company	2,402,500
In favour of Keystone Bridge Company	$187,500

The proposal of the Keystone Bridge Company is therefore the most favourable of these two companies. Each, however, state in their tenders that they have mutually agreed to a division of the work in case either of them obtained the contract.

Fifth.—Relative values of the proposals of the Keystone and Phœnix Bridge Companies.

The proposal of the Keystone Bridge Company for their superstructure plan is	$2,402,500	
Extra cost of masonry required by the greater width of their plan	6,999	
Total	$2,439,499	$2,439,499
The proposal of the Phœnix Bridge Company as originally made was	2,414,612	
Correction for lighterage, May 8	24,000	
Total	$2,438,612	$2,438,612
Balance in favour of Phœnix Bridge Company		$ 887
If we also consider the extra 1,300 cubic yards of masonry to be added to the Keystone piers to equalize the bearing pressures, we should have additionally in favour of the Phœnix Bridge Company 1,300 cubic yards at $17.40		22,620
Total in favour of Phœnix plan		$ 23,507

DUTIES.

The superstructure of the Keystone Bridge Company weighs 27,400 gross tons and they estimate the customs duties to be $639,149, or at the average rate of $23.33 per ton.

The superstructure of the Phœnix Bridge Company weighs 22,956 gross tons and they estimate the duty on metal work constructed in the United States at $22 per ton.

Assuming the lower of these figures for the duty by the ton or $22, for the purpose of comparison, we find that the excess of duties for the Keystone plan would be 4,444 tons at $22, $97,768.

CONCLUSION.

From the facts and considerations as stated above I find the cantilever superstructure plan of the Phœnix Bridge Company an exceedingly creditable plan from the point of view of its general proportions, outlines and its constructive features.

I also find that it is designed in accordance with your specifications.

The tender accompanying this plan is the lowest in price and is the most favourable as to the prospective duties upon the materials to be used in its construction.

I therefore hereby conclude and report that the cantilever superstructure plan of the Phœnix Bridge Company is the 'best and cheapest' plan and proposal of those submitted to me for examination and report.

I likewise report that the general plans and proposals for the substructure made by the Engineering Contract Company and by Messrs. Davis & Sons are both satisfactory and at favourable terms.

Very respectfully submitted.

THEODORE COOPER,
Consulting Engineer.

June 23, 1899.

The following table gives the estimated quantities of materials in the several proposed plans:—

Plan.	Steel. — Gross tons.	Cables. — Gross tons.	Timber. — Million.	Masonry. — Cubic yards.
Union Bridge Co.	14,286	3,125	1·6	23,700
Lindenthal	18,334	5,564	0·757	39,738
Pencoyd, Dominion	21,070	7,143	1·5	32,454
Phœnix Cantilever	22,956		1·547	69,400
Keystone "	27,400		1·4815	71,731
Dominion "	27,400		1·5	71,834

SUPPLEMENTARY REPORT.

The previous report upon the several plans and proposals for the construction of the proposed Quebec bridge has been based upon the plans and papers submitted by each competitor.

Any plan or proposal accepted by the Quebec Bridge Company will undoubtedly need more or less modification, either in the line of bettering its general appearance or to adapt it to any new conditions which may be developed by a more extended study and examination of the river bottom and other circumstances.

The approach spans and other comparatively minor features will need careful study and consideration, after the special general plan has been selected.

While the data shown upon the river profile were sufficient for the purpose of obtaining comparative proposals, they are not sufficient to locate exactly the final position of the piers or to determine the proper proportions of the supporting caissons.

Before proceeding with the channel piers, the character of the material of the river bottom upon which the stability of the piers will depend, should be determined with greater certainty than can be done by a few isolated borings.

For any depths exceeding those to which it is proposed to sink these channel piers, the additional cost, risks, and uncertainties increase very rapidly. It is imperative, therefore that it be known beforehand that the material upon which the caissons are to rest and get their support is suitable for the loads to be imposed upon it by such an important structure.

While it is probable that this material is a post-glacial deposit, well solidified by ages and permanent in character, I consider it important to ascertain this by a fuller examination by means of boring and trial shafts sunk into this material.

The expense of such an examination would be very small compared to the possible cost of changes made after the work is in progress.

It may also be found desirable to investigate the possibilities of further economies in the construction of both piers and superstructure.

I would suggest therefore that provision be made in the superstructure contract for any modifications that may be made by your engineers, either in changing the length of the spans, within reasonable limits, in modifying the carrying capacity of the structure or in increasing or decreasing the quantities of the materials. It might also be desirable to ask the successful competitor to state what reductions, if any, could be made in the tender by certain modifications of the specifications.

In like manner provision should be made for any modifications made by your engineers in the size, depths or locations of the piers and their caissons.

Very respectfully submitted,

THEODORE COOPER,
Consulting Engineer.

June 23, 1899.

EXHIBIT No. 11.

THEODORE COOPER,
CONSULTING ENGINEER,
35 BROADWAY, NEW YORK, May 1, 1900.

Hon. S. N. PARENT,
President, Quebec Bridge Company,
Quebec, Canada.

DEAR SIR,—In compliance with your request, I have taken up the examination of such modifications in the accepted plan for the Quebec bridge as were suggested by me in my report of last June.

The most important of these modifications, and the one requiring immediate attention, relates to the most desirable length to be selected for the channel span. The law, as well as the conditions of the river channel, require that this span must not be less than sixteen hundred feet. Would a greater span than sixteen hundred feet be more favourable is the question to be answered.

The piers, as located for the span of this length (1,600 feet), require foundations from 90 to 95 feet below ordinary high water.

They will stand in water from 30 to 40 feet deep, where they will be subject to the full ice effects of this river. Piers capable of performing the proper resistance to the conditions of the location have been designed and their cost established by competitive bids.

As the river bottom rises rapidly towards the shore on each side of the river, it is readily seen that the foundation conditions and also the ice effects are greatly improved by lengthening the channel span. Necessarily, however, the cost of the metal superstructure will be increased by using a longer span.

While in my report upon the competitive plans I suggested the desirability of investigating this question of a greater span, it could not be done at that time for want of time and also because a proper investigation required that one of the competitive plans, yet unselected, should be used in the consideration.

Now that you have selected the desirable plan a comparison can be made upon the basis of a greater length of channel span.

After a careful consideration of all the conditions by your chief engineer, Mr. E. A. Hoare, and myself, it was decided that an 1,800-foot channel span was most desirable if the expense was not too great.

I have therefore made an estimate for the change from a 1,600 to an 1,800-foot channel span, with the following results:—

The saving in cost of the piers and other masonry will be about $400,000.

The additional cost of the superstructure, upon a liberal estimate, would be about $600,000.

But modifications can be made in the plans, which, in my opinion, are desirable and justifiable, and which in no manner reduce the carrying capacity of the structure or render it incapable of fully performing all its duties satisfactorily, which would reduce the above increase of cost to about $450,000.

From either point of view, whether the increased cost of making the change in the span be $50,000 or $200,000, I consider the change justifiable for the following reasons:—

First. The construction of the larger and deeper piers of the 1,600-foot span will require at least one more year than those for the 1,800-foot span.

Second. The contingencies of the construction of the deeper piers in the deeper water, where they might possibly be subject, in their incomplete condition, to the heavy ice floes of the main channel, would be far greater than for the piers further inshore.

Third. The effect upon any future financing by reducing the time of construction and minimizing the real and imaginary contingencies.

I would, therefore, recommend that a channel span of 1,800 feet be adopted, and the contractors for the superstructure be directed to prepare plans accordingly.

Very respectfully, your obedient servant,

THEODORE COOPER.

EXHIBIT No. 18.

Copy No. 100816.

EXTRACT *from a Report of a Committee of the Honourable the Privy Council, approved by His Excellency on the 15th August, 1903.*

On a memorandum dated 13th August, 1903, from the Minister of Railways and Canals, representing that by an Order in Council of the 21st July, 1903, authority was given, in accordance with a suggestion made by the Chief Engineer of the Department of Railways and Canals, for the employment of a competent bridge engineer to examine from time to time detail drawings of the superstructure of the bridge across the River St. Lawrence near Quebec, now in course of construction, in view of certain modifications suggested by the consulting engineer of the bridge company; the said plans to be submitted, for final acceptance, to the chief engineer of the Department of Railways and Canals.

The minister further represents that the chief engineer has this day reported, stating that, as the result of the personal interview had with the company's consulting engineer, he would advise that, provided the efficiency of the structure be fully maintained up to that defined in the original specifications attached to the company's contract, the new loadings proposed by their consulting engineer be accepted; all detail parts of the structure to be, however, as efficient for their particular function as the main members for theirs, the efficiency of all such details to be determined by the principles governing the best modern practice, and by the experience gained through actual test; all plans to be submitted to the chief engineer, and until his approval has been given, not to be adopted for the work.

The minister recommends that authority be given for following the course so advised by the chief engineer, the Order in Council of the 21st July last to be modified accordingly.

The committee submit the same for approval.

JOHN J. McGEE.
Clerk of the Privy Council.

INDEX OF EXHIBITS, 70 TO 83.

Correspondence from 1897 to 1907.

Date.	From.	To.	Subject.	Exhibit No.
1897, July 7	Deans	Hoare	Visit to Bridge, &c	75-A.
1897, Nov. 8	Deans	Hoare	Plans, &c	75-D.
1897, Nov. 30	Deans	Hoare	Plans with straight chord	75-C.
1898, Dec. 12	Barthe	Deans	Extension of time for tenders	80-F.
189-, Jan. 29	Hoare	Deans	Preliminary arrangements	80-E.
189-, March 2	Hoare	Deans	Last tender received	80-G.
1899, April 14	Deans	Hoare	Conference, *re* plans	75-D.
1899, April 19	Deans	Hoare	Conference, *re* plans	75-E.
1899, Sept. 14	Deans	Parent	Banking	75-G.
1899, Nov. 28	Deans	Parent	Banking	74-H.
1900, Feb. 2	Deans	Hoare	Mr. Burbank's visit	75-I.
1900, April 21	Barthe	Deans	Approval of agreement	75-J.
1900, Sept. 11	Hoare	Deans	Maximum uplift	80-K.
1900, (?) Dec. 7	Hoare	Deans	Visit of Mr. Barthe to Phœnixville	80-L.
1901, Feb. 4	Deans	Hoare	Trial diagrams	74-A.
1901, Feb. 25	Deans	Hoare	Subsidies	74-B.
1901, March 26	Deans	Hoare	Approach spans	74-C.
1901, May 11	Deans	Hoare	Approach spans, &c	74 E.
1901, June 17	Deans	Hoare	Starting the work, &c	81-N.
1901, Aug. 9	Deans	Hoare	Agreement, &c	74-G.
1901, Aug. 23	Deans	Barthe	Estimates, &c	74-H.
1901, Oct. 29	Deans	Cooper	Eye-bars, approach spans	74 K.
1901, Nov. 18	Deans	Hoare	Approach work, customs, duties, &c	81-O.
1901, Dec. 2	Szlapka	Hoare	Estimated weights	81-P.
1902, Jan. 15	Barthe	F. T. Davis	Authority to draw on M. P. Davis	80-M.
*190 2, Jan. 20	Deans	Cooper	Information to public	70-A.
—— March 31	Hoare	Deans	Conference in New York	80-J.
*1902, April 2	Hoare	Cooper	Finances	70-B.
*1902, June 5	Hoare	Cooper	Progress and finances	70-C.
*1902, Oct. 3	Hoare	Cooper	Visit to Quebec	70-D.
1903, Oct. 22	Deans	Hoare	Pier foundation	74-P.
1902, Dec. 1	Deans	Hoare	Cost estimate	74-Q.
1903, May 20	Szlapka	Cooper	Stress specifications	74-R.
*1903, May 22	Deans	Cooper	Specifications	70-G.
1903, May 22	Deans	Cooper	Ottawa visit	74-S.
*1903, May 26	Szlapka	Cooper	Specifications, &c	70-F.
*1903, May 28	Deans	Cooper	Specification changes	70-E.
1903, May 28	Deans	Cooper	Loads and strains	74-T.
*1903, June 2	Cooper	Hoare	General letter	73-A.
*1903, June 4	Deans	Cooper	Revised specifications	70-H.
1903, June 12	Hoare	Deans	Cooper's amended specifications and attitude of department	80-O.
1903, June 15	Deans	Hoare	Revised specifications	74-N.
*1903, June 16	Cooper	Hoare	Weight, &c	73-B.
*1903, June 16	Szlapka	Hoare	Changes in specifications	73-B2.
*1903, June 29	Parent	Fitzpatrick	Ratifications of designs	70-J.
*1903, July 1	Hoare	Cooper	General letter	70-I.
190-, July 3	Hoare	Deans	General	80-Q.
*1903, July 18	Fitzpatrick	Parent	Order in Council	73-C
1903, July 24	Deans	Hoare	Fitzpatrick letter	74-V.
*1903, July 30	Szlapka	Cooper	Floor plan	74-A.
*1903, July	Schreiber	Cooper	Modifications in specifications	70-K.
*1903, July 31	Deans	Cooper	Order in Council	70-L.
1903, July 31	Deans	Hoare	Order in Council, &c	74-W.
*1903, Aug. 1	Deans	Cooper	Order in Council	70-M.
1903, Aug. 3	Deans	Hoare	*Re* "proposed appointment"	80-P.
1903, Aug. 4	Cooper	Hoare	Trouble over approval plans	80-P2.
190-, Aug. 19	Hoare	Deans	"Mr. S.," &c	80-R.
*1903, Sept. 5	Deans	Cooper	Visit to Ottawa	70-N.

*From Mr. Cooper's letter-books.

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*1903, Oct. 23	Szlapka	Cooper	Floor system, &c	71-B.
*1904, Feb. 19	Szlapka	Cooper	Stress diagram, &c	71-D.
*1904, April 27	Hoare	Cooper	Inspection	71-E.
*1904, May 3	Deans	Cooper	Anchor bent	71-F.
*1904, May 5	Hoare	Cooper	Inspectors	70-O.
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*1904, May 17	Edwards	Cooper	Instructions	71-C.
*1904, May 20	Hoare	Cooper	*Re* Edwards	70-P.
*1904, May 26	Szlapka	Cooper	Anchor eye-bars, &c	71-G.
*1904, May 26	Szlapka	Cooper	Live load	71-H.
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1904, June 11	Szlapka	Cooper	Camber lengths	74-Z.
1904, June 22	Deans	Cooper	Eye-bar packing	74-AA.
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*1904, July 28	Szlapka	Cooper	Bottom chord	71-K.
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1904, Sept. 5	Deans	Milliken	Chaudiere Yard	74-GG.
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1904, Sept. 12	Szlapka	Hoare	Calculations of anchor arm	74-KK.
1904, Sept. 14	Hoare	Szlapka	Stress sheets	80-T.
1904, Sept. 19	Deans	Hoare	Stress sheets	74-LL.
1904, Sept. 19	Hoare	Deans	Bottom chords panel 2, anchor arm	80-U.
1904, Oct. 8	Deans	Hoare	Government approval	74-NN.
*1904, Oct. 17	Szlapka	Cooper	Top lateral stresses	71-L.
*1904, Dec. 2	Edwards	Cooper	Shop errors	71-M.
1904, Dec. 3	Deans	Hoare	Printed specifications	74-OO.
*1904, Dec. 12	Edwards	Cooper	Weights, anchor arm	71-N.
*1905, Jan. 19	Edwards	Cooper	Eyebar tests, &c	71-O.
1905, Jan. 26	Cooper	P. B. Co	Eyebar tests	80-A.
*1905, Jan. 28	Cooper	Edwards	Eyebars	73-F.
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1905, Feb. 2			Memorandum Cooper interview	74-SS.
*1905, Feb. 15	Cooper	Edwards	Eyebars	73-G.
1905, Feb. 22	Deans	Norris	Eyebar tests	74-TT.
*1905, March 8	Hoare	Cooper	Inspection	71-P.
*1905, March 11	Edwards	Cooper	Weighing	71-Q.
*1905, March 25	Deans	Cooper	*Re* McLure	71-R.
*1905, March 31	Hoare	Cooper	*Re* McLure	71-S.
*1905, May 18	Hoare	Edwards	Rolling material	71-T.
1905, May 18		Edwards	Rolling of material ahead of time	80-V.
1905, June 15	Hoare	Q. B. Co	Calculations	80-W.
*1905, July 7	Hoare	Cooper	*Re* cheque	71-U.
1905, July 8	Deans	Hudson	Damaged chord	76-A.
*1905, July 11	Szlapka	Cooper	Stress diagram	71-V.
*1905, July 12	Deans	Cooper	Chord sections 9	71-W.
1905, July 13	Hoare	Deans	Chord A 9L	81-I.
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*1905, July 17	Hoare	Cooper	Shell plates, &c	71-X.
1905, July 21	Deans	Hoare	Splicing angles of chord 9	81-K.
1905, July 21	Deans	Hudson	Chords 7, 8 and 9	76-C.
1905, July 21	Deans	Hoare	Splicing angles	76-B.
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*1905, July 29	Deans	Cooper	Field inspection	
*1905, Aug. 11	Szlapka	Cooper	Eyebars, &c	
*1905, Aug. 12	Szlapka	Cooper	Drawings	

*From Mr. Cooper's letter books.

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1905, Aug. 19	Deans	Parent	Storage yard connection	76-I.
*1905, Aug. 21	Hoare	Cooper	*Re* Mr. McLure	71-BB.
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1905, Nov. 22	Milliken	Deans	Close of season	76-L.
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*1906, Feb. 1	Szlapka	Cooper	Struts	72-A.
*1906, Feb. 10	Hoare	Cooper	Weight, estimate	72-B.
1906, Feb. 10	Hoare	D. Reeves	Material	76-S.
*1906, Feb. 17	Szlapka	Cooper	Chord 8 R	72-C.
1906, Feb. 17	Szlapka	Cooper	Error in chord	76-T.
*1906, Feb. 19	Cooper	Szlapka	Chord 8 R, &c	73-E.
1906, Feb. 19	Cooper	Szlapka	Errors in chords	80-D.
*1906, Feb. 26	Edwards	Cooper	Eyebars, &c	72-D.
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1906, June 1	Deans	Milliken	Working platform	76-W.
*1906, June 2	Edwards	Cooper	Trip to Boston	72-E.
1906, June 8	Deans	Milliken	Riveting, &c	76-X.
1906, June 8	Deans	Milliken	Drillings, &c	76-X.
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1906, Aug. 9	Hoare	Milliken	Paint	80-Y.
1906, Aug. 20	Deans	Milliken	Field corrections	77-C.
1906, Aug. 22	Deans	Milliken	Steel bents	77-D.
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1906, Oct. 6	Deans	Milliken	"U.P.-3" and packing	77-N.
1906, Oct. 4	P. B. Co.	Milliken	Camber plates	77-L.
1906, Oct. 8	Deans	Milliken	Relations with Mr. McLure	77-N.
*1906, Oct. 16	Szlapka	Cooper	End post	72-G.
1906, Oct. 16	P. B. Co	Milliken	Falsework	77-O.
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1906, Oct. 22	Deans	McLure	Supplying information	77-P.
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*1906, Nov. 16	Szlapka	Cooper	Shop drawings	72-H.
*1906, Nov. 26	Edwards	Cooper	Error in pin hole	72-I.
1906, Nov. 26	Milliken	Deans	Season's work	77-W.
1906, Dec. 27	Szlapka	Cooper	Transmitting drawings	77-Y.
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*1907, Feb. 13	Szlapka	Cooper	Stress sheet, susp. span	72-J.
1907, March 6	Deans	Hoare	Weight of bridge	78-B.
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1907, March 19	Deans	Hoare	Starting work, &c	78-E.

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*1907, March 21	Wright	Szlapka	Rivets in centre web	72-K.
1907, April 3	Deans	Norris	Injured chord	78-F.
*1907, April 6	Edwards	Cooper	Post, section, &c	73-I.
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1907, May 20	Deans	McLure	Riveting instructions	78-L.
1907, May 20	Hoare	Deans	Plans for Dept	78-M.
1907, May 21	Hoare	Deans	Complaints of engineers at Ottawa	81-B.
*1907, May 21	Deans	Cooper	Drawings	72-M.
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1907, May 27	Hoare	Deans	Delay in forwarding plans for approval	81-C.
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1907, May 31	Deans	Parent	North approach	78-Q.
1907, June 14	Hoare	Deans	Payments due	81-Q.
1907, June 15	Deans	Yenser	Sagging bottom laterals	78-S.
1907, July 3	Deans	Parent	North approach	78-V.
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1907, July 12	Deans	Yenser	Driving pins, deflect., cant. arm, &c	78-Y.
1907, July 24	Deans	Yenser	Live load and specifications	79-A.
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1907, July 26	Yenser	P. B. Co	Report on work	82-B.
1907, Aug. 6	Birks	P. B. Co	Splice between chords 7 L and 8 L	81-D.
1907, Aug. 8	Deans	Parent	Storage	79-C.
1907, Aug. 8	P. B. Co	Milliken	Splicing 7 and 8	79-E.
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*1907, Aug 9	Cooper	Deans	Repairs to chord	73-J.
1907, Aug. 10	Deans	Cooper	Splicing 7 and 8	79-I.
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*1907, Aug. 13	Cooper	McLure	Bend in 7-8 L	73-K.
1907, Aug. 14	Deans	Yenser	Splicing 7 and 8	79-K.
1907, Aug. 14	Deans	Cooper	Splicing 7 and 8	79-L.
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1907, Aug. 16	Birks	P. B. Co	Splice 7 L and 8 L	81-E.
1907, Aug. 20	Deans	Cooper	Splice 7 and 8	79-N.
*1907, Aug. 21	Cooper	Deans	Bend—7-8 L	73-L.
1907, Aug. 23	Deans	Cooper	Splice 7 and 8	79-O.
1907, Aug. 24	Yenser	P. B. Co	Report on work	82-D.
1907, Aug. 24	Yenser	P. B. Co	Daily force account	82-F.
1907, Aug. 24	Deans	Norris	Material for north side	79-P.
1907, Aug. 24	Yenser	P. B. Co	Report on work	82-C.
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1907, Aug. 26	Deans	Yenser	Office and field figures	79-Q.
*1907, Aug. 26	Cooper	Deans	Bent ribs	73-M.
1907, Aug. 27	Deans	Cooper	Splice 7 and 8	79-R.
1907, Aug. 27	Birks	P. B. Co	Chords 9 L anchor arm and 8 and 9 R cant. arm	81-F.
1907, Aug. 28	Hoare	P. B. Co	McLure's call *re* chord	79-S.
1907, Aug. 28	Birks	P. B. Co	Chord 9 AA	81-G.
1907, Aug. 29	Deans	Hoare	Chords in condition they left Phœnixville	79-T.
1907, Aug. 29	Cooper	P. B. Co	Add no more load	79-U.
1907, Aug. 29	Yenser	P. B. Co	Report on work	82-G.
1907, Aug. 29	Birks	P. B. Co	Chord 9 AA	81-H.
1907, Aug. 29	Yenser	P. B. Co	Weight on end cant. arm, Aug. 29	82-Y.
1907, Aug. 29	Yenser	P. B. Co	Daily force account	82-J.
1907, Aug. 29	Yenser	P. B. Co	Report on work	82-H.
1907, Aug. 30	Weitnight	P. B. Co	Report on collapse	79-Z.
*1907, Aug. 31	Berger	Hoare	Chord 7-8 L	73 N.
*1907, Sept. 2	Cooper	Hoare	Letter of sympathy	73-O.
1907, Sept. 14	P. B. Co	F. T. Davis	Preserving blue prints	79-BB.
1907, Sept. 16	Connard	Deans	Original specification	79-DD.
1907, Sept. 16	Deans	Connard	Asking [illegible]	79-CC.

*From Mr. Cooper's letter books.

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1907, Sept. 26.	Hoare	Szlapka	Revised strain calculations	79-GG.
1907, Sept. 27.	P. B. Co.	Hoare	Blue prints of calculations	79-HH.
*1907, Oct. 4.	Berger	Schneider	Wind strains	73-P.

*From Mr. Cooper's letter books.

EXHIBIT No. 70a.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., Jan. 20, 1902.

THEO. COOPER, Esq.,
Consulting Engineer,
35 Broadway, New York, N.Y.

DEAR MR. COOPER,—I have your letter of January 18 in connection with giving out information concerning Quebec bridge. I discussed this matter with Mr. Hoare soon after our last interview on this subject, and he stated he thought it would be wise to defer publishing any matter. We expect some definite and clear action in connection with the main structure during March or April, and until this is taken and all features definitely fixed and decided upon, I think it might be wise not to give out any information to the public, and this appears to be Mr. Hoare's feelings in the matter. We have been so frequently pressed regarding this matter that we have promised to give all of the engineering papers the information at the same time. I have not been in New York since the annual meeting, but shall stop in your office the next time I am in the city.

With kind regards,

Yours truly,

JOHN STERLING DEANS,
Chief Engineer.

EXHIBIT No. 70b.

(Letterhead of Quebec Bridge Co.)
(Private.)

QUEBEC, April 12, 1902.

DEAR MR. COOPER,—I called at your office on Thursday afternoon on my return from Phœnixville. You had gone home about half an hour previously. As I had nothing in view to fill up another day, I left the same evening for home. Mr. Parent came to New York, but left again the same day with his family. He hadn't very good news for future progress, and I am afraid our intentions will be checked for a while. There can't be any move in connection with new work this year on account of de-

ferred finances. We have only enough to scratch through this year's work and only with Davis' help in taking scrip. I have told Davis that he can take reasonable time about his plan studies as there will be nothing ordered for some time. I said not before end of year at earliest, all depending upon success of terminal scheme. The above is private. If I had seen you again I could have explained the scheme which has been deferred. I saw a 15″ x 2″ bar tested which failed in the body, about 29,000 lbs. elastic limit and nearly 56,000 lbs. ult., being the fourth satisfactory test. In haste.

Yours truly,

E. A. HOARE.

EXHIBIT No. 70c.

(Letterhead of Quebec Bridge Co.)
(Personal.)

QUEBEC, June 5, 1902.

DEAR MR. COOPER,—I will send a few hasty lines before going up the river to thank you for yor letter of the 2nd inst. and inclosure. I was at the point of writing when your letter came, but was called off for something else. Mr. Davis' work is progressing. The second caisson is at site, but not quite lined. We are loading with concrete and levelling bottom at low tide under air pressure. I am afraid there will be a halt this fall as our programme failed to mature. I hope, however, it may be revived next winter in time for some arrangements for the following year. Until then I am afraid we shall be stranded for money. Everything has been scratched together and transferred to Mr. Davis, which will only contribute a portion. He has to carry a portion on his own shoulders. When your account comes in I will try same† source to procure engineering funds as soon as possible, if you don't mind a little delay in meantime. The present available funds will be absorbed locally in a couple of months or so. When anything of importance occurs you will hear from me.

Yours truly,

E. A. HOARE.

† Some.

EXHIBIT No. 70d.

Telegram.

QUEBEC, QUE., Oct. 3, 1902.

THEODORE COOPER,
35 Broadway, New York.

Could you be here next Thursday to meet Mr. Schreiber. Preparations for winter demand decision for final depth not later than then.

E. A. HOARE.

EXHIBIT No. 70e.

(Letterhead Phœnix Bridge Co.)

PHŒNIXVILLE, PA., May 28, 1903.

THEO. COOPER, Esq.,
Consulting Engineer, Quebec Bridge Co.,
35 Broadway, New York, N.Y.

DEAR SIR,—We were very sorry to learn by Mr. Berger's letter of May 25th that the grip had hold of you, and trust by this time you have been able to knock it off.

Mr. Szlapka has carefully examined the proposed revised specifications as to loads and strains Quebec bridge and same is returned herewith, with several notes in red, which we believe you will add as agreeing with original understanding.

We would further suggest that the last clause, under the head of 'Future increase or railroad live load,' be added immediately after the live load clauses and before the wind clause.

As you will undoubtedly appreciate, it will be necessary for you to explain to Mr. Hoare how the live load proposed in these specifications will easily take care of any possible increase in live load without overstraining the material. I know personally that Mr. Hoare and his people feel that the bridge should be designed to provide for a considerably heavier load than originally intended.

It has occurred to us that it might be well to add, after the second paragraph in live load clause, the following:—'This loading being equivalent to Engine E-40 with train load of 4,000 lbs. per lineal foot on one track and Engine E-40 with train load of 2,000 lbs. per lineal foot on other track.' We simply make this to you as a suggestion, that parties examining specifications may have it directly before them that ample provision is made for heavy loading.

We notice you omit to add that the workmanship and material is to be in accordance with 'Cooper's specifications.' Please add this clause.

Knowing the people in Canada are very anxious to have the matter settled, we understand you will forward to Mr. Hoare at once these revised specifications. Kindly send a copy to us.

Yours truly,

JOHN STERLING DEANS,
Chief Engineer.

EXHIBIT No. 70f.

(Letterhead Phœnix Bridge Co.)

PHŒNIXVILLE, PA., May 20, 1903.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We return herewith, by registered mail, your proposed specifications for loading and unit stresses, main span, Quebec bridge. I wish to make the following remarks in reference to these specifications:—

1st. I assume that only one engine E-40 will be used on each railroad track.

2nd. I find that the proposed 48,000 lbs. on two axles 10 ft. centre to centre on trolley stringers produce larger bending moment in centre than the 40,000 lbs. on two axles 7 ft. apart centre to centre originally used.

3rd. E-33 on each railroad track to be used for chords and main diagonals for the suspended span ,is equivalent to 4,200 lbs. per lin. ft. on one track and almost 2,000 lbs. per lin. ft. on the second track.

4th. I tried formula proposed for main members and find in each case there will be a slight saving of material and that the unit stresses come within the limit of about $\frac{7}{8}$ths of the elastic limit for live and dead load stresses.

5th. On page 2 of your specifications there should be added the same remark as on page 3, written *by you in pencil* and marked by me with red *asterisk*.

6th. I examined the values of the permissible unit stresses for reversed strains, and I find in some cases there are slight errors, as indicated by me in red.

After you have these specifications rewritten and printed complete, I would be glad once more to have the opportunity of looking over them before they are sent to Canada for adoption.

P.S.—I have retained a copy of your papers.

Yours respectfully,

PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 70g.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., May 22nd, 1903.

THEO. COOPER, C.E.,
35 Broadway, New York, N.Y.

DEAR MR. COOPER,—I returned from Ottawa yesterday, and you will be pleased to learn there is every evidence to believe that the programme as outlined by Mr. Parent in your office recently will be carried out.

I was requested by the Ottawa officials to urge upon you to act as promptly as possible in the matter of completing the specifications and to forward same to Mr. Hoare without delay. There is urgent necessity of their taking prompt action. Will you kindly write Mr. Hoare when he may expect to receive copy of the revised specifications.

I will stop to see you the next time I am in New York, which will undoubtedly be within a few days, and give you more details.

JNO. STERLING DEANS.
Chief Engineer.

EXHIBIT No. 70h.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., June 4, 1903.

THEO. COOPER, Esq., C.E.,
Consulting Engineer,
35 Broadway, New York, N.Y.

DEAR MR. COOPER,—I acknowledge receipt by your letter of
revised specifications Quebec bridge, which you sent to H

thank you for the copy and hope we will soon hear that these specifications have been approved by the government.

Hoping you are entirely recovered from your recent attack of grip, I remain,

Yours truly,

JNO. STERLING DEANS,

EXHIBIT No. 70i.

(Letterhead of the Quebec Bridge Co.)

Private.

QUEBEC, July 1st, 1903.

DEAR MR COOPER,—I enclose copy of letter which Mr. Parent approved of and signed and which I handed to Mr. Fitspatrick (our representative member) yesterday in Ottawa. We showed it to Mr. Schreiber who approved of it and requested Mr. Fitzpatrick to obtain the consent of the Minister of Railways and Canals to proposals therein. I expect that this part of the programme will be closed this week. Regarding your specification, to-day being a holiday, I was unable to get Mr. S. to take it up with me, as Douglas was absent for a few days, and Mr. S. wished to see him in regard to it before committing himself. He said, however, that I may expect a letter in a day or two , probably putting questions for your explanation. Mr. S. said he would go to see you if he wasn't so tied up attending committees. I think the hitch, if any, will be on the method of loading and straining metal to $\frac{3}{4}$ of elastic limit, which may require explanation direct. I do not think that financing will be as easy as supposed in these quarters. The government have not yet decided on any guarantee, but, from what I can gather here and there, it will not cover the whole required by the company. In such a case we don't want to be loaded with greater outlay than necessary. At the same time the future usefulness and permanency of the bridge for all possible traffic must not be sacrificed on account of temporary financial conditions. Therefore, if you have satisfied the above by your specifications I would suggest clinging to your proposals and overcome criticism by discussion such as we had at your office the other day. It might also be well for you to satisfy Mr. S. that when strain diagrams are being prepared you may find it necessary to increase where special conditions require it and that the present specification provides for maximum results when properly handled and that you require plenty of scope to work out satisfactory details and not be tied down to unreasonable conditions, thereby impairing your usefulness as consulting engineer. I spoke to him on these lines, hoping that it may have a little impression before Douglas returns. I found a message from Phœnixville this morning urging an agreement as they were at a standstill and could not proceed as Deans promised the premier when here six weeks ago. Is there anything they can do in the meantime in preparation of any kind, for I fear we shall take a week longer to arrive at conclusions. Please excuse a hurried random letter to catch mail.

E. A. HOARE.

SESSIONAL PAPER No. 154

EXHIBIT No. 70j.

(Letterhead of the Quebec Bridge Co.)

QUEBEC, 29th June, 1903.

The Hon. CHARLES FITZPATRICK,
Minister of Justice, Ottawa.

DEAR MR. FITZPATRICK,—Mr. Hoare has been to New York to confer with Mr. Cooper, the consulting engineer of the Quebec Bridge Company, and the chief engineer of the Phœnix Bridge Company upon the arrangement of certain matters which will govern the rate of progress of work on the bridge. In that regard, the preparation of the general drawings, and those required for the shops at Phœnixville, is a very stupendous affair, requiring expert supervision and a large staff of special draughtsmen at work for many months before details are ready for the workshops. It is absolutely imperative that the continuous flow of the working drawings to the shops shall not at any time be interrupted, as the slightest delay will most assuredly lose a season's erection. If the usual course of submitting plans to the Department of Railways and Canals (which may work very well in ordinary cases), is followed, delays will certainly occur, and in order to avoid anything of the kind, I urgently ask you to have an arrangement made by which all specifications and designs signed by Mr. Theodore Cooper be accepted by the government. Mr. Schreiber would, I should think, be pleased to have such an arrangement made whereby work could be compressed and simplified and responsibility taken by such an experienced bridge engineer as Mr. Cooper, who has been specially engaged for that purpose.

Yours truly,

S. N. PARENT,
President.

EXHIBIT No. 70k.

(Letterhead of Dept. of Rys. & Canals, Ottawa.)

OTTAWA, July, 1903.

DEAR SIR,—I have received from Mr. E. A. Hoare two memoranda made by you in respect of the plans of the superstructure of the Quebec bridge, suggesting certain modifications which you consider desirable.

Inasmuch as the contract for this structure contains an express specification by which I am bound, I am unable, as matters stand, to sanction any deviation from it.

I am, however, strongly impressed with the expediency, in order not to hinder the progress of the work of manufacture, of permitting you certain latitude in the preparation of the detail plans, even to the extent of adopting (with my own concurrence) such modifications as may appear proper, and, holding this view, I have asked that authority be given me by order in council which will enable me to act in that direction. Nothing can, of course, be done until such order is passed, but on receipt of it I will communicate with you immediately.

Faithfully yours,

COLLINGWOOD SCHREIBER,
Chief Engineer.

THEODORE COOPER, Esq.,
Consulting Engineer,
35 Broadway, New York

EXHIBIT No. 701.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., July 31, 1903.

THEODORE COOPER, Esq.,
Consulting Engineer,
35 Broadway, New York, N.Y.

DEAR MR. COOPER,—To say that I was surprised by the contents of your letter of July 30th is putting it mildly. I am trying to reach Mr. Hoare by 'phone. In addition, I have wired him and have also written a strong letter expressing my feeling in the matter.

The suggested action by Mr. Schreiber would place the business in a much worse condition than it was originally in. The 'order in council' was taken solely to save time and to have your approval of our details final and binding on the government—it simply being necessary to have Mr. Sschreiber's signature as a matter of form. It has certainly proven to be a thankless task so far in trying to save the Quebec Bridge Company a large amount of money without in the least affecting the efficiency of the structure.

We, of course, agree with you that we are at a standstill until this matter is settled, as certainly the matter of a new engineer is an uncertain quantity at present.

I cannot but believe that a trip to Quebec by yourself and myself would tend to clear the situation.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 70m.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., August 1, 1903.

MR. THEO. COOPER, C.E.,
35 Broadway, New York, N.Y.

DEAR MR. COOPER,—I talked with Mr. Hoare over the 'phone yesterday (the service was not very satisfactory), and also wired him two long messages, and have received his reply stating that 'he will take up the question with parties at Ottawa and that we should go ahead, and if anything turns up to cause *trouble, tell Cooper to let me know at once.*' I have written him again and urged him to stop entirely this proposed plan, and explaining that the sole purpose of the order in council was to give you the final authority to settle all details, the government approval being a mere formality, and in this way save time which was so valuable. I personally think it would have been much better to have had Douglas, as originally proposed, rather than to have the present plan carried out; but we must insist upon having the whole matter stopped.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 70n.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., Sept. 5, 1903.

THEO. COOPER, Esq.
Consulting Engineer,
Cooper's Plains, Steuben Co., N.Y.

DEAR MR. COOPER,—I was pleased to learn by your letter of Sept. 2nd that you had found it possible to take a rest, and trust you will be greatly benefited by the change. We will follow your directions should anything of importance come up in connection with Quebec during your absence.

I was called to Quebec and Ottawa by a telegram from Mr. Parent on Tuesday last to meet government officials and satisfy them as to the reasonableness of the cost of our portion of the structure. Mr. Davis was present to make the same statement in connection with his part of the work. It was evident that the government were making final arrangements to bring a Bill before parliament covering guarantee of bonds to complete the work. I believe this action will be taken within a short time.

Yours truly,
JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 70o.

(Letterhead of Quebec Bridge Co.)

QUEBEC, May 5, 1904.

THEO. COOPER, Esq.,
35 Broadway, New York City.

DEAR SIR,—Mr. Johnson and a friend of mine, who is inspecting work for me in Montreal, have recommended a Mr. John Rankin, now engaged as inspector on the Trent canal, as a competent mill and shop inspector for our work. Both Johnson and Griffiths state that he has had considerable experience in both kind of works and is very reliable, and has been educated as an engineer, I believe, at McGill College. I have asked Mr. Rankin to write to you direct, stating his experiences from the start, in order that you may judge of his capabilities. If you think him a desirable man, I can negotiate with him and get him probably within two weeks. Another man named W. S. Walls has also been recommended to me by the same gentlemen, they state that Walls has had a little more experience than Rankin. He was shop superintendent of the Elmira Bridge Co., also the Lackawanna Steel Co. He was engaged for some time by the Pittsburg Testing Laboratory and also by the late George S. Morrison. Rankin is a Canadian-born subject and Walls an American. I have inquired about others, but the majority that apply are totally unfit for our work. Deans says he must have inspectors at Phœnixville by the 15th instant in order to spend a little preliminary time to become acquainted with their works and the shop drawings, etc. Would like to hear from you on this subject at your earliest convenience, also to have the letters in hand in reference to matters discussed in New York the last time I was there. I may as well inclose for your perusal a letter from Mr. Rolph, making an application to the Canadian Inspection Company for a position as inspector metal work. You might let me know if you think this man would be worth trying as a junior. I know I can get him if he is suitable.

Yours truly,
E. A. HOARE.

EXHIBIT No. 70p.

(Letterhead of Quebec Bridge Co.) QUEBEC, May 20, 1904.

THEODORE COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York.

DEAR SIR,—I have received your letter of the 16th stating that you have engaged Mr. Edwards as inspector at Phœnixville. I haven't had an opportunity to get confirmation by the Board but I am satisfied that it will be all right. I received a letter from Mr. C. Deans to know if there would be an opportunity to get a part of this inspection as compensation for lost labour in figuring on the original contract bids with Phœnix Company. I suppose you have arranged for checking shop drawing weights in the manner already attended to or in some similar way. Consequently the only way to fit in Deans (if at all) would be some distant mill inspection, say a limited quantity that may be rushed in the future at some distance from Phœnixville, which might not interfere with the latter organization. I mention this in case of unforeseen rush. If you think Rankine efficient for the future, when required, you can let me know. I imagine, however, that he will require an answer in a month, or not much later.

Yours truly,

E. A. HOARE.

EXHIBIT No. 70q.

(Letterhead of Quebec Bridge Co.)

QUEBEC, July 21, 1904.

THEODORE COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York City.

DEAR SIR,—The Department of Railways and Canals are going to send a resident inspector to Phœnixville to follow our inspector's work and keep track of all metal out of Canada in such a manner that when paid for, it can be claimed at any time by this company and the government. At the same time I imagine that the weight of metal will be checked by the government man in the manner previously mentioned. If it is arranged that the government man and Mr. Edwards can satisfactorily do this, there is no use of troubling you about it, as you probably have all the work you desire in hand. I will let you know later the actual arrangements made.

I was sorry to hear that you were called away to attend your brother's funeral.

With best regards,
Yours truly,

E. A. HOARE.

EXHIBIT No. 70r.

August 1, 1904.

Mr. E. T. MORRIS,
Inspector, the Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—James River Viaduct, Richmond, Atlantic Coast Line—I have just learned of carelessness in not following out the full and very explicit instructions given

on the drawings. These must be carried out to the letter. We must insist upon this and if there is to be any modifications from these instructions, it must be given from this office. The proper time to have made the corrections on these girders was when they were first sent out of shop and not wait until time arrives for them to be riveted together. I believe you now understand exactly what is to be done, and will see that girders are made in strict accordance with the drawings.

Quebec.—I believe you have been told verbally about the importance of the inspection of the Quebec bridge material, not alone the material for the bridge proper, but particularly the material for the falsework and traveller. This must have the same careful inspection as permanent work and particularly as to the material and workmanship about the joints.

Yours truly,

JOHN STERLING DEANS,
Chief Engineer.

EXHIBIT No. 71a.

(Letterhead of Phœnix Co.)

PHŒNIXVILLE, PA., July 30, 1903.

THEO. COOPER, Esq.,
Consulting Engineer,
35 Broadway, New York, N.Y.

DEAR SIR,—We send you in duplicate preliminary floor plan for the St. Lawrence river bridge at Quebec. This plan shows the floor arranged with a future sidewalk on the main span and on the approach spans, as well as the cross section of floor with sidewalk temporarily omitted.

We made several changes, as compared with the Quebec Bridge Company's specifications. We increased the 3-inch planking on the roadway to 4 inches ; spaced the 8 x 12 railway ties 14 inches instead of 12 inches, and we omitted the two outside railway guard timbers 8 x 9 inches, which appear to be unnecessary having inner steel guard rails.

The centre posts over the main piers being 5 feet wide over-all and some of the diagonals packing out also about 5 feet, the future sidewalk has to be 5 feet clear outside of these dimensions.

The depth of the roadway stringers and the electric stringers is not yet decided upon until this floor plan is approved by you. We will then figure the exact dead weight of the wooden floor and proceed to the design of the steel floor.

Please return one plan with your approval and oblige.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 71b.

(Letterhead of Quebec Bridge Co.)

PHŒNIXVILLE, PA., October 23, 1903.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—Under separate inclosure we send you five blue prints of drawing 'A' showing wooden floor system, main bridge, St. Lawrence river crossing. Kindly retu

four of the sheets with your approval as far as the wooden portion of the cross-section is concerned.

We also send you two sheets showing general layout of the main bridge and especially showing the character of the curve of the upper chord of the suspended span. From this you will notice that this curve produced comes about 2 feet above the second panel point from the main pier. Kindly retain these prints for your office use.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 71c.

POTTSTOWN, May 17, 1904.

THEODORE COOPER, C.E.,
Consulting Engineer, Quebec Bridge Co.,
New York.

DEAR SIR,—Beg to acknowledge receipt of your favour of the 16th inst., directing me to proceed to Phœnixville and to report to the Phœnix Bridge Company as inspector for the Quebec Bridge Company.

I thank you for kindly assigning me to this work, and assure you I will use my best endeavours to prove your confidence has not been misplaced. I note what you say regarding salary, and if this is agreeable to the chief engineer it will be so to me.

Would report that I called at the office of the Phœnix Bridge Company to-day as per your request, and was informed by their Mr. Deans that they expect to order material for the anchorage shell early next week.

I will be notified when this is done, and also be furnished with the necessary drawings and bills of material. I will keep track of the work now from this time on, and give prompt attention to any inspection which may arise. I remain,

Yours very truly,

E. L. EDWARDS.

EXHIBIT No. 71d.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, PA., February 19, 1904.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We send you herewith in duplicate stress diagram and general detail drawing of the 675-foot suspended span, Quebec bridge, and also our calculations in detail for same. With these calculations in hand the checking of our figures will be very much simplified.

While our general plan shows the principal features of the details to be used,

these details naturally may be subject to further changes when the final shop drawings for this span are made.

For erection purposes the upper chord sections are spliced in the field ahead of the panel points, while the panel splices will be shop riveted.

For the same reason the eyebars at the intersection with the sub-panels are attached to two separate pins by means of a special link.

Our plan shows the lower chord stiff throughout, although it may be found later on more convenient for erection to make the two centre panels of eyebars.

As noted on our plan, the details of the end portals, of the end floor beams, of the end stringers and the arrangement for transferring the lateral stresses from the suspended span into the cantilever, will be furnished later.

If you find it necessary to discuss any of our details in person, the writer will be glad to call at your office any day you may name. Kindly return one print with your approval, and oblige,

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

P.S.—Our detailed calculations are for your office use and need not be returned.

EXHIBIT No. 71e.

(Telegram.)
Dated Quebec, Que., 27

Received at
NEW YORK, April 27, 1904.

THEODORE COOPER,
35 Broadway, New York.

Think I can find in a few days satisfactory men for all inspection purposes.

E. A. HOARE.

EXHIBIT No. 71f.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, May 3, 1904.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send you to-day six sets each of drawings T, U and V, being general detailed drawings of the anchor bent, Quebec bridge. Kindly affix your signature to these drawings and return same, so that we may forward them to Mr. Hoare for government's approval.

Yours truly,

JNO. STERLING DEANS, C.E.E.,
Chief Engineer.

EXHIBIT No. 71g.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, May 26, 1904.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send you herewith in duplicate more complete drawings, sheets T, U and V, which may be necessary to you in checking our shop drawings No. 1 and No. 2, being eyebars, pins and pilots for the anchor bents, which plans we also send you herewith in duplicate.

The anchor eyebars are made of different lengths, owing to the fact that they are differently inclined from the bottom end pin towards the upper end pin, and also owing to the fact that the present anchor bars projecting 6 feet above the anchor piers are at slightly different elevations, as given to us by Mr. Hoare.

We understand, as already mentioned by you, it will not be necessary for us to bend the eyebars at their heads, owing to the slightly larger amount of slanting than generally specified.

We expect to send to you the bracing in the anchor bent on Saturday and the legs not later than Wednesday next.

Kindly return to us the two sheets of eyebars, pins, &c., at your earliest convenience, as we wish to make a start of rolling material in the mills, and in this way satisfy the Dominion government that the actual construction of the bridge in the shops has begun.

Yours truly,

THE PHŒNIX BRIDGE COMPANY,
Per P. L. SZLAPKA.

EXHIBIT No. 71h.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, PA., May 26, 1904.

THEO. COOPER, ESQ.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send you herewith in duplicate:—

Calculations of pins in anchor bents.

Calculation of anchor tower.

Calculation of twin floor beam over anchor bent.

Complete stress sheet of anchor arm with the exception of end portal, intermediate sway bracing and bracing and trussed floor beams between centre posts.

These calculations show every position of live load used in obtaining maximum stresses. They also show the several cases of wind pressures on page 4—so that with all secants, tangents, &c., given, you will be enabled to make very rapid progress in checking our calculations.

As soon as you are through with these calculations and you wish any features of the calculations explained, corrected, or supplemented, the writer will be glad to call at your office.

Your truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 71i.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, PA., June 7, 1904.

THEO COOPER, ESQ.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send you in duplicate, additional sheets showing bending moments on pins of anchor arm, Quebec bridge, namely: Sheet 31 to 38, inclusive, and 44 to 46, inclusive.

In the course of two or three days we will send you the missing sheets for pins for post P-4 and centre post.

We would be greatly obliged to you, if Mr. Berger could see his way of checking the lower part of the main tower and return to us one of our plans approved, not later than next Friday—as our shops are greatly in need of this material.

Yours truly,
THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 71j.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, PA., July 1, 1904.

THEO COOPER, ESQ.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—To eliminate the additional compressive stresses on the lower chord of the anchor arm, due to the bending under its own weight, we propose to move the centre line of the pins ½-inch below the centre of gravity of the chord. Kindly advise if you agree with us in this matter and oblige,

Yours truly,
THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 71k.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, PA., July 28, 1904.

THEO. COOPER, ESQ.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send herewith for your examination and approval in duplicate:—
Drawing No. 1 C. O. 616, 617.
Drawing No. 1 C. O. 606, 607.
Drawing No. 12 C. O. 616, 617.

The end bottom chord plan was previously approved by you and we send you this plan owing to the fact that small changes were added and you requested us to send another set of drawings as finally arranged.

Kindly return one of each with your approval, and oblige.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 711.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, PA., October 17, 1904.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We have your letter of October 14, referring to additional stresses caused in the top laterals by their weight, in addition to the wind stresses. We considered this point, but finding that the dead load stresses are less than 10 per cent of the wind stresses, we did not provide any additional section. Your standard specifications permit this assumption. The unit stresses—20,000 lbs. per sq. in. being less than the maximum permissible stress of 24,000 lbs. for all combined stresses, would be an additional reason for not providing any additional section, or any additional rivets for the dead load stresses. Kindly advise us again on this point, and oblige,

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 71m.

PHŒNIXVILLE, December 2, 1904.

List of errors of account made by the shop in the construction of posts and chords for the anchor arms of Quebec bridge:—

FOUR END BOTTOM CHORDS.—In consequence of the one end of these chords being faced $\frac{3}{32}$" out of square the connection holes for floor beams and which had been drilled from template were from $\frac{1}{8}$" to $\frac{5}{16}$" (maximum) out of their correct position in relation to the vertical line shown on drawing 7 C O 606-607.

Remedy.—The connection holes in end angles of end floorbeams were drilled to correspond with the holes in the chords. This shifting of holes in floor beams from the position as originally intended left at the top hole at least $\frac{1}{2}$" metal from side of hole to edge of angles and more material proportionately as the holes approached to the bottom of the floor beam.

No. 2 BOTTOM CHORDS.—On chords A-2-R and A-2-L (S. anchor arm) and A-2-R (N. angle arm) 14" pin holes were bored $\frac{5}{16}$-inch too low.

Remedy.—Bottom sections of post P 1 bored to correspond with pin holes in above chords.

No. 3 BOTTOM CHORD S. ANCHOR ARM.—Chord A-3-L (S. anchor arm) 3/32" short from centre of pin hole to faced end (short end, so-called.)

Remedy.—Abutting No. 4 chord lengthened by the amount this chord (A-3-L) was short.

UPPER SECTION OF POST P 1.—This section mark AUPR (N. anchor arm) was not set straight in the boring mill and in consequence this section was bored 1/16" on one side longer than the other.

Remedy.—Pin hole was re-bored for 12⅛" pin, and connecting eyebars will be bored to correspond with this pin hole.

HANGER A T O L, SOUTH ANCHOR ARM.—This hanger did not 'true up' on two ribs in boring the upper 12" pin hole. Ribs were re-bored to 12⅛" and after bushing re-bored for 12" pin. Bushing 1/16" thick (finished) and secured with four dowels—¾" x 1¼".

E. L. EDWARDS.

EXHIBIT No. 71n.

PHŒNIXVILLE, December 12, 1904.

THEODORE COOPER, C.E.
Consulting Engineer on Quebec Bridge and Railway Company.
New York.

DEAR SIR,—I beg to send you herewith a memorandum showing the weights of some parts shipped within the past few weeks for the south anchor arm of Quebec bridge. Duplicates of these parts have been stored here for use on the north anchor arm.

Would report that the shop work is progressing steadily. The boring of 15" eyebars for panel D is now under way, in fact about 25 bars are completed. We pinned eight of these (picked out indiscriminately) and results were very satisfactory. In my inspection of 15" eyebars found two bars 15" x 2"—51'—3 21/32" (c to c) mark A-D-2 which were 3/64" too long. These bars have been put aside for the present. Chord A-6-L for south anchor arm we found 1/32" short (at short end). Abutting No. 7 chord will be lengthened by this amount. I presume that this will meet your approval.

The forging of 15" eyebars has been improving very much lately and decidedly better than some of those which you saw at the eyebar plant on the occasion of your last visit here.

Yours very respectfully,

E. L. EDWARDS.

P.S.—No 15" eyebars will be shipped till Mr. Szlapka has arranged with you in reference to further full sized tests. He expects to see you this week, I believe.

EXHIBIT No. 71o.

PHŒNIXVILLE, January 19, 1905.

THEODORE COOPER, C.E.,
Consulting Engineer of the Quebec Bridge and Railway Company,
New York.

DEAR SIR,—Enclosed please find reports of two tests made on one 15" x 1 1/8" eyebar. You will note that the elastic limit in both tests are rather low and in the case

of No. 20 the ultimate strength is 55000. I would therefore respectfully refer these tests for your consideration.

I would report the rejection of one pin (in addition to three previous ones) intended for anchor arms. This pin had fine seams running throughout its length.

No. 9 chord (A-9-L) for N. anchor arm we found the pin hole $\frac{3}{32}$" larger than the pin instead of $\frac{3}{64}$" allowed. Chords A-9-L and A-9-R for south anchor arm we find $\frac{1}{8}$" short from pin hole to end (long end). This occurs on one side of these chords only. the outside dimensions (from c of hole to end) are O.K. in both cases. The chords referred to will not be accepted by us till I have conferred with you later.

Yours very respectfully,

E. L. EDWARDS.

EXHIBIT No. 71p.

(Letterhead of the Quebec Bridge and Railway Company.)

QUEBEC, March 8, 1905.

THEODORE COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—I received a letter from Mr. Edwards regarding the inspector I mentioned to you the other day. I asked Mr. Edwards to see you with reference to this man's capacity to assist at Phœnixville, to become acquainted with the mechanical features of the work at the shops, and finally to be transferred to the field during the summer season. It is not easy to judge of a man by correspondence, but if you saw Mr. Edwards and the applicant you would soon decide whether he was capable, and if not we can look for others.

I received a letter from Kinloch this morning. He is the man I employed on the approach spans and whom I found to be very capable mechanically, and he has had previous experience in shop as well as field work. Kinloch would make a good second field inspector, as I don't think he has technical knowledge to qualify him for first place. I expect we will require more than one inspector in the field after getting fairly started.

Yours truly,

E. A. HOARE.

EXHIBIT No. 71q.

POTTSTOWN, March 11, 1905.

THEODORE COOPER, C.E.,
Consulting Engineer for the Quebec Bridge Company,
New York.

DEAR SIR,—On the occasion of Mr. Hoare's recent visit to Phœnixville he expressed the wish to have the weighing witnessed of as much material as possible. As every minute of our time is occupied, he stated that another man could attend to this and assist with clerical work and other duty.

I told Mr. Hoare that in case neither you nor he had any one in view, I knew of a man whom I thought would be suitable. Mr. Hoare writes me that after consulta-

tion with you it was decided to have some one assist at Phœnixville for a while and later take up erection. The man I had in mind is a young man of about 24 years of age. His experience has been purely practical, having spent four years with shipbuilding concerns and three years in the inspection of material at mills and bridge shops. While such a man could be used to advantage in assisting at the shops, his experience is probably not sufficient for such important work as inspector on erection.

From a conversation I had with you on the subject last fall you stated that you would prefer some young man who had experience in figuring strains. Just at present I do not know of a man who would be entirely suitable, but I would, if you wish, inquire and report to you. It is possible that Prof. Marburg, of University of Pa., and whom I know quite well, could recommend such a man as you desire.

I am, yours very truly,

E. L. EDWARDS.

EXHIBIT No. 71r.

(Letterhead of the Phœnixville Bridge Company.)

PHŒNIXVILLE, PA., March 25, 1905.

Mr. THEODORE COOPER,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—This letter will be handed you by Mr. N. R. McLure. Since I have talked with Mr. McLure, I feel he has had just the experience which you desire for a man to be your representative Quebec field inspector.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 71s.

(Letterhead of Quebec Bridge Co.)

QUEBEC, March 31, 1904.

THEODORE COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—I have your letter of the 28th, stating that you have engaged Mr. N. R. McClure, late bridge inspector for the N. Y. O. and W. Ry., to go to Phœnixville as assistant inspector to prepare for the position of inspector of erection at Quebec, &c., &c.

On Wednesday I wired Mr. Edwards stating that if no arrangements had been made for an inspector I had some capable men in view to select from, residents of Montreal, who had previously held positions at a distance and were just about returning home. The man that you have selected, however, may be quite as capable.

Yours truly,

E. A. T

EXHIBIT No. 71t.

(Letterhead of Quebec Bridge Co.)

QUEBEC, May 18, 1905.

E. L. EDWARDS, Esq.,
Inspector,
c/o. Phœnix Bridge Co., Phœnixville, Pa.

DEAR SIR,—Answering your letter of May 5, respecting rolling of material ahead of plans approved, &c., for cantilever arms and suspended span, particulars of which I mentioned to you when in Phœnixville last week, will you please see Mr. Cooper with Mr. Deans or with Mr. Szlapka, so as to come to an understanding as to the class and quantity of metal that can be rolled, inspected and accepted for monthly progress estimates. The understanding with me is that Mr. Deans or Mr. Szlapka is to get the necessary plans approved by Mr. Cooper before he can sign any more estimates for work outside of anchor arms, towers and a limited quantity of plate metal agreed to for cantilever arms, and not to deliver metal for the cantilever arms or suspended span before the time required to prepare it for delivery in time for erection at the specified periods. Besides that Mr. Deans is to furnish me with plans ahead of any material ordered, to be approved by the Chief Engineer of the Department of Railways and Canals of Canada.

The above must be complied with before any more material is estimated, outside of the anchor arms, towers and floor system.

See Mr. Cooper, that you may get instructions before the end of this month.

Yours truly,

(Unsigned.)

EXHIBIT No. 71u.

(Letterhead of Quebec Bridge Company.)

QUEBEC, July 7, 1905.

THEODORE COOPER, Esq.,
Consulting Engineer,
35 Broadway, New York City.

DEAR MR. COOPER,—Replying to your letter received this morning, I reminded the accountant a week ago to send your cheque. Upon inquiry this morning, however, I find that it has not been sent. He will mail it to-day and provide for the draft discounts, which I stated to you would be refunded. In future he will send half yearly, as requested.

Sorry to hear that you are not up to the mark. Hope to see you soon.

Yours truly,

E. A. HOARE.

P.S.—No permanent metal erected yet.

EXHIBIT No. 71v.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, July 11, 1905.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We send you herewith two additional copies of stress diagram for cantilever arms, St. Lawrence river bridge.

Kindly notice that, as you requested, we increased the sections of diagonals T-4 and T-40 and vertical post P-4. We also corrected erection wind stresses on subposts S.P. 3, S.P. 4 and S.P. 5.

We send you also in duplicate page 11a, showing sections required for the several truss members on the assumption, that the entire wind stresses are used in combination with live and dead load. The said wind stresses being calculated for wind blowing either on the suspended span only, or on the cantilever arm only.

Please increase on your pages 9 and 10 the sections of diagonals T-4, T-40 and post P-4.

The corrected erection wind stresses, namely, 78,000 lbs. for S. P. 3, 450,000 for S.P. 4, 469,000 for S.P. 5 are to be used only in combination with positive erection stresses on the above members for traveller standing in its extreme position.

The negative erection stresses for these three members are obtained, of course, with the traveller standing *in their panels*, for which position the wind stresses are insignificent.

We hope with these corrections and explanation the stress sheets will be entirely satisfactory to you and will be finally accepted.

Yours truly,

THE PHŒNIX BRIDGE COMPANY.
Per P. L. SZLAPKA.

EXHIBIT No. 71w.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., July 12, 1905.

THEODORE COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send you herewith in duplicate chord section 9, for cantilever arms, St. Lawrence river bridge. This is the first drawing sent for your approval of the cantilever arm and we expect to send you additional drawings from now on. Kindly return one with your approval and oblige.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 71x.

(Letterhead of Quebec Bridge Company.)

QUEBEC, July 17, 1905.

THEODORE COOPER, Esq.,
Consulting Engineer,
35 Broadway, New York City.

DEAR SIR,—In a few days we expect to commence placing the shell plates on the south anchor pier. I have on the work an experienced bridge inspector, who proved to be very satisfactory on the other work. McLure will not be needed here just now. Will advise later.

A chord member marked A-9-L met with an accident which caused the bending of lattice angles and cracked two legs of flange angles. I have thoroughly examined the whole piece and found nothing else wrong. Repairs can be made here, and I requested Phœnix Bridge Company to show you the points on the plan and get your approval before doing anything.

Your truly,

E. A. HOARE.

EXHIBIT No. 71y.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., July 24, 1905.

Mr. THEODORE COOPER,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR MR. COOPRR,—I have your letter of July 22, in connection with field inspection. I will certainly stop in to see you the next time I am in New York, and I expect to be over this week.

Mr. Milliken writes me that Mr. Hoare has been expecting to make us a visit, and I trust he may come down before the first of the month, so that between us we may get this matter in satisfactory shape. If Mr. Hoare does not come down, I think it will be necessary for me to see him on other matters at a very early date, in which case I will take up the question of inspection with him, but only after seeing you.

Yours truly,

JNO. STERLING DEANS.

EXHIBIT No. 71z.

(Letterhead of Phœnix Bridge Company.)

PHŒNIXVILLE, PA., August 11, 1905.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Answering your letter of August 4, referring to bars and shop drawings of cantilever arm, Quebec bridge, we beg to state that we will be glad to substi-

tute 12" bars for 15" bars for diagonals T 1 and T 10 if the additional thickness of these bars permits this change, without encroaching on the clear width of the bridge.

We have sent you corrected diagrams of the cantilever arm showing the modified normal lengths and the camber lengths, which no doubt you will find correct.

We thank you for calling our attention to an error in wind strain in upper chord section F, namely, giving stress as 1,056,000 instead of 456,000, which error was made by reading wind stress on cantilever arm as 110,000 instead of 710,000, the 7 being very indistinct in the original.

Yours truly,

PHŒNIX BRIDGE COMPANY,
Per P. L. SZLAPKA.

EXHIBIT No. 71aa.

(Letterhead of Phœnix Bridge Company.)

PHŒNIXVILLE, August 16, 1905.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR MR. COOPER,—As Mr. Hoare has not been down since I last saw you, I have arranged to go to Quebec to-morrow, and one of the first things I will take up will be the matter of inspection, and you will hear from me promptly, certainly not later than early next week.

The last report from Mr. Milliken, which was this morning, he had ten lower chord sections in place—he placed four chord sections in one day—traveller handled the sections, as Milliken put it, 'as easily as ordinary rigging handled an eyebar.' We should be raising trusses in about ten days.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 71bb.

(Letterhead of Quebec Bridge Company.)

QUEBEC, August 21, 1905.

THEODORE COOPER, Esq.,
Consulting Engineer,
35 Broadway, New York City.

DEAR SIR,—The work is about in shape now to need the services of Mr. McLure here. The field office for his and Mr. Kinloch's accommodations will be ready by the time he reaches here. Besides certain work that he will have to perform for this office and records required by the Dominion government, &c., please instruct Mr. McLure what special work you require him to do on your account. I have told him to come here for about three months, and afterwards go to your office or elsewhere to compute the weights of metal from shop drawings to check the same which have been made by he Phœnix Bridge Company. I will send Mr. Kinloch into the Phœnix machine shop for the winter, as, besides having had large experience in bridge erection, he is a first class shop man.

Yours truly,

E. A. HOARE.

EXHIBIT No. 72a.

(Letterhead of the Phœnix Bridge Company.)

PHŒNIXVILLE, PA., February 1, 1906.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—Answering your letter of January 23rd, referring to our drawing 76-C.O. 621-622, showing top strut at post 'P-3,' we beg to state that we are not quite as yet ready to say we have sinned.

The 4 angles 4" x 4" forming the strut are supported by latticing at alternate points, so that at a section through the centre of a panel only two angles are not supported, while the other two are cut at their panel points.

It is also not necessary to assume for unsupported distance of the 4" x 4" angles the panel lengths, there being at the latter plates 9" x ⅞" x 16" long, so that the actual unsupported distance may be taken between the end rivets, thus shortening the panel lengths by 12".

We have also to consider that the seeming overstraining of the struts takes place only at the 4 truss panel points next to the main pier or about 350 feet from the end of the cantilever arm.

At this great length of the truss exposed to the high wind pressure it would appear reasonable to use higher wind stresses for the struts than at the end of the cantilever arm.

In other words, using a formula: $22500\text{-}100\,\frac{1}{r}$ we find the sections provided for the struts satisfactory.

Since the corresponding *4 struts* in the anchor arm have been made with sections based on the same calculations as the cantilever arm, we think that no just criticism can be made if the struts are left as at present designed.

We also beg to add that the material for the struts in question is rolled.

Hoping that our explanation of the reasons for the details of the struts as shown on our plans will be found satisfactory by you, we remain,

Yours very truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 72b.

(Letterhead of the Phœnix Bridge Company.)

QUEBEC, February 10, 1906.

THEODORE COOPER, Esq., C.E.,
Consulting Engineer,
35 Broadway, New York, N.Y.

DEAR SIR,—I have written to Mr. Reeves stating that on account of a possible reorganization for the completion of the Quebec bridge we may be hurriedly called upon for final figures to complete the structure ready for traffic.

Omitting the end span, the figures given me for the larger structure—upon which we have based all calculations—are for total weight of 29,736 tons, which at the time I stated looked insufficient. I have already returned for payment about 29,000 tons which do not include suspended span and considerable of the cantilever arms, showing that the total weight has been underestimated.

Under the circumstances will you kindly check the revised Phœnix figures which I have asked for.

From current returns of work done to date I do not think the total weight will be far short of 35,000 tons.

Yours truly,

E. A. HOARE.

EXHIBIT No. 72c.

(Letterhead Phœnix Bridge Co.)

PHŒNIXVILLE, PA., February 17, 1906.

THEO. COOPER, ESQ.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—As reported to you by Mr. Edwards, chord 8R on cantilever arm was faced at long end 7/64" out of square, so that while one rib is of the exact length, the other three are short—the outer rib being short 7/64".

There are two methods of correcting this error—

1st. We might reface the chord, so that the end will be square and the long section will be 7/64" short. This method would cause bending on the hanger to the amount of 7/64", as the stringers in this panel are fixed at both sides. The end of the cantilever arm would drop about ¼", owing to the short panel

2nd. We might reface the chord, making the section say ¼" short and replace this material by a filler securely doweled to each rib and to the exact shape of each rib. This would preserve the panel of the exact length.

I am inclined to believe that the second method is preferable, and if you agree with me I will permit the shops to proceed with this method of correction. Please advise us as early as possible as the shops are anxious to finally complete the chord.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 72d.

(Letterhead Phœnix Bridge Co.)

PHŒNIXVILLE, PA., February 26, 1906.

THEO. COOPER, C.E.,
Consulting Engineer of the Quebec Bridge Co.,
New York.

DEAR SIR,—Your letter of the 24th instant has been received and carefully noted. I have infomed Mr. Szlapka of the conditions under which you will accept the 19 eyebars in question. The understanding being that ten bars (5 for each struss) will be applied on the south cantilever arm and nine on the north arm. These 19 bars to have some distinguishing mark so they can be easily picked out and distributed as you have directed. I have shown Mr. McLure your letter, so that he understands the situation.

Regarding shop errors, would say that it is very disheartening to us to come across so many lately, and I certainly agree with you that a repetition of errors should be stopped. This is just what we are endeavouring to do, but appear to be up against a pretty tough proposition at present, but believe we will get better results before long. I am certainly working to this end. Mr. Norris stated some time ago that we had given closer attention to our work than any job that had ever gone through their shops. We have endeavoured to do this at least, knowing the importance of the work.

In reference to the new estimate of weights, Mr. Szlapka will have this prepared, and before being submitted to you will be checked over by Mr. McLure. Mr. McLure has the weight (actual) of south anchor arm and centre posts and bracing, and will commence figuring from lists and drawings the weight of members on the cantilever arm. When this is finished he will compare with Mr. Szlapka, who now has the estimated (from drawings) weights of the members of the cantilever arm from centre post to post P 2.

I am, yours very respectfully,

E. L. EDWARDS.

P.S.—In regard to weight of suspended span, Mr. McLure says he will have to get at this approximately.

EXHIBIT No. 72e.

(Letterhead, Theodore Cooper, Consulting Engineer, 35 Broadway.)

NEW YORK, June 2, 1906.

THEODORE COOPER, C.E.,
New York.

DEAR SIR,—Mr. Berger informs me you will not be at your office to-day. I blame myself for not advising you that I would be here to-day, but as I have never missed you in the past the possibility of not seeing you to-day did not occur to me.

With Mr. Hoare's permission, I will be away from Phœnixville next week on a trip with my family to Boston. I will stop to see you on my way back. May I ask you to kindly sign the May estimate and send to Mr. Hoare.

In reference to estimate, would say that under 'Total to date' the amount 54,261,279 includes all the raw material for anchor and cantilever arms, with the exception of about 1,000 tons of eyebars and plates for cantilever arm.

The amount of manufactured material under 'Trusses and bracing,' and which is 47,708,669, includes all material for north and south anchor arms, excepting two (2) pedestals, and for the cantilever arm (excepting panel 1) all chords, posts 4 and two sections of posts (Nos. 3 and 2). Hangers, all except two now under way. Most all bracing is included, also about 500 eyebars for the south cantilever arm and 300 for the north cantilever arm.

Regarding floor beams and stringers, there is practically no change since last month, viz., all are completed in the shop for the cantilever arm excepting those for panel 1.

Nothing ordered yet for the suspended span.

Mr. Hoare has not asked to have the estimate at Quebec at any particular time, so that if sent on the 4th no doubt this will be agreeable to him.

I am, yours very respectfully,

E. L. EDWARDS.

EXHIBIT NO 72f.

(Letterhead, Phœnix Bridge Co.)

PHŒNIXVILLE, PA., September 15, 1906.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York.

DEAR SIR,—Replying to the latter part of your letter of September 13, revised stress sheet will be sent to you as soon as prints can be made.

Yours truly,

JNO. DEANS,
Chief Engineer.

EXHIBIT No. 72g.

(Letterhead, Phœnix Bridge Co.)

PHŒNIXVILLE, PA., October 16, 1906.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send you herewith our calculations of the end post of the suspended span, Quebec bridge. Our drawing for this end post, as sent you, is deficient in one respect, that is, the latticing on the post below the lower transverse strut is not distinctly shown, as consisting each of two angles 4″ x 3″ x 8½ lbs. per foot, thus securing double shear rivets. Above the lower transverse strut, where the shear is considerable less, single angle lattices and single shear rivets are sufficient. These lattices were figured on the assumption that the transverse shear on each post consisting of 128,000 lbs. is resisted half by the cover plate and half by the lattice system. The combined unit stress on the extreme fibre of the post due to live load, dead load and wind is less than 20,000 lbs., which is certainly a very low value. The material for the post is all rolled and delivered at shop. We hope our design of the post will be satisfactory to you.

Yours truly,

THE PHŒNIX BRIDGE COMPANY,

$$\text{No. 700} \left(\frac{337.5'}{28.125'}\right)\frac{1}{2} = 228.000 \text{ per post.}$$

Per P. L. SZLAPKA.

EXHIBIT No. 72h.

(Letterhead Phœnix Bridge Co.)

PHŒNIXVILLE, PA., November 16, 1906.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We send you in duplicate several shop drawings for your examination and approval, including more complete plan showing adjustment-arrangement during

connection of suspended span. These drawings complete all the shop drawings of the cantilever arm. Kindly return the print with your approval.

We have already started on the shop drawings of the suspended span, which being simpler than either the anchor or cantilever drawings will require less time and consequently will reach your office in quicker succession.

Yours truly,

THE PHŒNIX BRIDGE CO.,

Per P. L. SZLAPKA.

EXHIBIT No. 72i.

PHŒNIXVILLE, PA., November 26, 1906.

THEODORE COOPER, C.E.,
Consulting Engineer for the Quebec Bridge Co.,
New York.

DEAR SIR,—In reference to post EPR (for north side of the suspended span) which had the 12 7/8" pin hole bored on a skew and which I reported to you on my last visit to your office, would say this post has now been re-bored to 12¾". Pin holes in chords 1 will also be bored 12¾" when these chords are made. A special 12 7/8" pin has been ordered. It is my understanding this is done with your approval.

Yours very respectfully,

E. L. EDWARDS.

EXHIBIT No. 72j.

(Letterhead of Phœnix Bridge Co.)

PHŒNIXVILLE, PA., February 13, 1907.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We send you herewith in duplicate stress sheet of the suspended span of Quebec bridge refigured for an increased dead load amounting to 14,500 lbs. per lin. ft. of bridge. The sizes of some of the truss members were increased to correspond to this increased dead load.

Yours truly,

THE PHŒNIX BRIDGE CO.,

Per P. L. SZLAPKA.

EXHIBIT No. 72k.

(Letterhead of the Phœnix Iron Works.)

PHŒNIXVILLE, PA., March 21, 1907.

Mr. P. L. SZLAPKA,
Phœnix Birdge Co.

DEAR SIR,—In answer to your letter of the 19th, referring to bottom chords, Quebec bridge, I have gone into this very thoroughly and find that we cannot drive rivets in centre web. We have no machine to do this with, it is not possible to design a machine to drive these rivets satisfactorily. I do not think there is such a machine in the market.

These holes are drilled to size, and there should be no difficulty in having a turned bolt made a driving fit, as the bolts can be driven from outside of chord by inserting a long bar through rivet hole on outside web. Hoping this will be satisfactory.

Yours truly,

R. W. WRIGHT.

EXHIBIT No. 72l.

(Letterhead of the Phœnix Bridge Co.)

PHŒNIXVILLE, PA., May 7, 1907.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We send you herewith seven (7) blue prints of all drawings marked 'II' on our list herewith; you have in your office seven (7) copies of all drawings marked 'I' on our list.

Kindly return all these drawing 'I' and 'II' with your signature at your earliest convenience. These drawings cover the entire cantilever arm, and as many parts of the suspended span as will be erected by the large traveller.

Respectfully yours,

Per P. L. SZLAPKA.

EXHIBIT No. 72m.

(Ltterhead of the Phœnix Bridge Co.)

PHŒNIXVILLE, PA., May 21, 1907.

THEODORE COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Referring to your advice to our New York office that you could not find drawings 13, 14, 72 of CO-621, 622—we are sending you seven prints of each drawing by mail to-day and would appreciate it greatly if you would sign and return them to us promptly. Mr. Hoare for some reason is very anxious to have certified copies of all drawings.

Yours truly,

JNO. DEANS,
Chief Engineer.

EXHIBIT No. 73a.

June 2, 1903.

DEAR MR. HOARE.—I have been laid up two weeks with grippe, and have not been able to do any work. I am much better, but still quite weak. Szlapka was here yesterday, and we cleared away some misunderstandings of each others' view as conveyed by writing. I send you the modifications of the specification as to material and workmanship, &c. Deans wanted me to specify according to my own specifications, but I thought this might be misunderstood. I did not understand that this was important at present.

I hope for the present at least my presence up there will not be required, as I am not in shape yet to go from home. Only come to the office for a short time even yet.

Hoping I have made my explanations of the specifications clear so that Schreiber will be satisfied.

I remain, yours very truly,

THEODORE COOPER.

P.S.—Of course, if it is thought best to make bridge still stronger, all right, but I have assumed that it was not desired to increase cost beyond estimate already made.

T. C.

EXHIBIT No. 73b.

June 16, 1903.

MY DEAR MR. HOARE,—I have answered the best I can your telegram of 15th

While it was my object in drafting the new specifications to get the best arrangement without materially reducing the weight, and a positive answer as to whether it will be reduced could only be determined by the actual strain sheets, I am inclined to think there will be for the 1,800-foot span a less weight than if proportioned under the old specifications. I know nothing as to the Pœenix contract draft or what they now propose. If they have given an estimated weight, I wish you would send it to me. Also it would be a guide if I knew whether the proposal is for a lump sum price or for a pound price; also whether 'the powers that be' desire to keep down as close as possible to the original estimates or are willing to go higher if the bridge can be bettered. I am only aiming to get all parts harmoniously strong and not have some parts weaker relatively than others.

Yours very truly,

THEODORE COOPER.

I am picking up strength, but am not good for much yet.

(Letterhead of the Phœnix Bridge Co.)

PHŒNIXVILLE, PA., 1903.

Mr. E. A. HOARE,
Chief Engineer, Quebec Bridge Co.,
Quebec, Canada.

DEAR SIR,—At the request of Mr. Deans, I send you herewith a sheet showing general comparison of your specifications of September 1, 1898, with specifications as now proposed by Mr. Cooper.

I took several actual instances to show what the exact figures would be as determined by either specifications.

The compression formulæ appear to be almost identical as shown for $^1/_r$ equal 60 and for $^1/_r$ equal 90.

As regards the wind pressure the values per lineal foot used by Mr. Cooper are equivalent to pressures per square foot proposed in your specifications.

With figures given I hope you will be able to see that the difference between the two specifications is very immaterial.

Where the new specifications give smaller sections than your specifications, it will be found during actual final computations, that owing to the magnitude of the structure and consequently the very large dead-load as compared with the live-load, the unit stresses selected are fully justified.

Yours truly,

P. L. SZLAPKA.

EXHIBIT No. 73c.

OTTAWA, July 18, 1903.

DEAR MR. PARENT,—The order in council was passed this morning giving Cooper the necessary authority to act as required by Hoare.

Yours sincerely,

C. FITZPATRICK.

EXHIBIT No. 73d.

August 6, 1904.

PHŒNIXVILLE BRIDGE COMPANY,
Phœnixville, Pa.

MY DEAR MR. SZLAPKA,—I have tested the proportions of the members of the anchor arm under the following maximum loading for my personal satisfaction, viz.:

Dead plus 1·5 live plus 25 lbs. of wind (½ of your wind strain) and find that the only members exceeding 24,000 in tension or 24,000—$100^1/_r$ for compression are:

The lower chord which has +26,500 and is all right, and

Towers L which should have 108 □

" $\overline{B}$ " " " 99 □ to come within the above conditions.

This is such a slight matter, I request, for the sentiment of the thing, that you change those last two members to the above sections if it does not inconvenience anything.

Yours very truly,

THEODORE COOPER.

EXHIBIT No. 73e.

February 19, 1906.

P. L. SZLAPKA, Esq.,
Phœnixville Bridge Company,
Phœnixville, Pa.

DEAR SIR,—In reply to yours of 17th inst., I regret very much these errors.

The only remedy for the chord 8-R seems to be the second method you propose. The dowels should be of such a character to insure the plates from being loosened or damaged.

For that centre cap, where all the pin holes have been bored too large, I see no satisfactory remedy but enlarged pins. The pin plates, to my surprise, have 20 per cent more pin pressure than the eyebars (should not have been so) and with the large holes will make this the weakest joint in structure, much to my regret. T-50, also have reversed strains, and the joints should be tight ones instead of being so free as now made.

Yours very truly,

THEODORE COOPER.

EXHIBIT No. 73f.

January 28, 1905.

Mr. E. L. EDWARDS,
Inspector for Quebec Bridge,
Phœnixville, Pa.

DEAR SIR,—You are hereby directed to accept no more eyebars for the Quebec bridge until further orders.

The present form of heads in use on these eyebars has been shown to be incapable of sustaining the working loads to be used, and a radical change in these heads is demanded. A long series of tests will be needed to solve this question.

As the change in the form and size of the head will affect the length of bars required, the company should stop further rolling of these bars.

You will please furnish the Bridge Company with a copy of this order.

Yours truly,

THEODORE COOPER,
Consulting Engineer, Quebec Bridge Co.

EXHIBIT No. 73g.

February 15, 1905.

E. L. EDWARDS, Esq.,
Inspector, Quebec Bridge,
Phœnixville, Pa.

DEAR SIR,—I have consented to the continuation of making eyebars for the anchor arms, but desire that the heads, as far as the lengths ordered will permit, be made at least 34 inches diameter, or with an excess of 47 per cent.

You can take up the inspection of these bars. No bars are to be accepted for the cantilever arm till further orders. Please inform the Phœnix Bridge Company of these orders.

Yours very truly,

THEODORE COOPER,
Consulting Engineer, Quebec Bridge Co.

EXHIBIT No. 73h.

(Letterhead Phœnix Bridge Co.)

PHŒNIXVILLE, Pa., August 12, 1905.

THEODORE COOPER, ESQ.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send you to-day in duplicate shop drawing of upper section sub-post S. P. 5, and also shop drawings of side struts.

Please notice that the section of the sub-post is increased owing to the manner in which theseveral truss members will be placed in position during erection.

We find that this sub-post receives its stress during erction of 1,200,000 pounds for which we provided 74·7 sq. in., using formula $p=27-112\frac{1}{r}$

Hoping you will return with your approval,

Yours truly,

The PHOENIX BRIDGE COMPANY,
Per P. L. SZLAPKA.

EXHIBIT No. 73i.

PHŒNIXVILLE, April 6, 1907.

THEODORE COOPER, C. E.,
Consulting Engineer for the Quebec Bridge Co.,
New York.

DEAR SIR.—Beg to acknowledge receipt of your favour of April 5, in reference to post sections C. P1 (R. and L.) C. O. 613.

These post sections I believe are satisfactory in every other respect, but we will make another inspection of them before shipment, as they have laid around the yard for quite a long time.

In reference to chord 10 LCO 622 which had been injured here in handling, would report that the ribs have now been straightened to our satisfaction. It was deemed best by the shop to heat some of the angles slightly at two points where outstanding legs were bent a little. After all work was done we examined the angles and ribs with magnifying glass and discovered no cracks. We have therefore accepted the chord as per your instructions.

Yours truly,

E. L. EDWARDS,

EXHIBIT No. 73j.

August 9, 1907.

JOHN STERLING DEANS, Esq.,
Chief Engineer, Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR.—Your telegram regarding chord joint at hand. The method proposed as sketched by Mr. McLure is not satisfactory as I telegraphed yesterday. These bent

webs can be pulled back by use of about 15 to 20 one inch bolts (in one and one sixteenth holes) threaded at both ends for nuts, passing from the outer to the inner bent webs. The outer straight web being stayed in some manner against its bending.

If the bent webs, after being pulled into line, tend to go back when released from the bolts, stays must be introduced to hold them in position. Possibly it may be necessary to permanently rivet in some of these one inch bolts.

Please let me know what method you propose to use.

It is a mystery to me how both these webs happened to be bent at one point and why it was not discovered sooner.

Yours truly,

THEDORE COOPER,

EXHIBIT No. 73k.

August 13, 1907.

N. R. McLURE, Esq., Insp. for
erection Quebec Bridge,
New Liverpool, P. Q., Can.

DEAR SIR,—Mr. Deans writes me that only one rib at joint 7 and 8 L is bent and that there is a full and complete bearing. That the bend was no doubt put in the chord in the shop before facing.

I have asked him to instruct his resident engineer to join with you in making an exact report, with dimensions, of the condition of this joint; with amount of bearing and if it is a square bearing or askew.

In reference to the splicing of T5 and T50 mentioned in your letter of 10th, I do not care to interfere with the regular programme as I have not followed the various actions of the loadings at different stages. Without going into it carefully, I think there will be more compression at these points, with more of the suspended span in place.

Please report promptly respecting joints 7 and 8 L with all the facts,

Yours truly,

THEODORE COOPER,

EXHIBIT No. 73l.

August 21, 1907.

JOHN STERLING DEANS, Esq.,
Chief Engineer, Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—I received copy of sketch of joint 7 and 8 L a few days ago.

I wrote Mr. McLure last week telling him none of the theories as to how this bending occurred were logical. That my theory was a blow on this rib after the two sections were in contact and that it probably was done in moving those suspended beams used in covering. To examine carefully to see if he could find any evidence of this. He has not yet reported. He did report a similar bend at L 8 and 9 west truss in same rib but of less amount.

I still believe this bend can be partly removed by use of long bolts with threads

at each end, outer rib being properly stiffened to prevent its bending. If it can be pulled nearer straight stays or bolts must be provided to hold it against future movement.

I cannot consent to let it go without further action, as the rivets in the cover splices would not satisfy the requirements to my mind.

Yours very truly,
THEODORE COOPER.

EXHIBIT No. 73m.

August 26, 1907.

JOHN STERLING DEANS, Esq.,
Chief Engineer, Phœnix Bridge Company,
Phœnixville, Pa.

DEAR SIR,—Mr. McLure reports he can find no evidence of the bent ribs having been hit, and does not think they could have been struck. This only makes the mystery the deeper, for I do not see how otherwise the ribs could have been bent.

When convenient I would like to discuss with Mr. Szlapka the best means of getting these ribs into safe condition to do their proper work.

Yours truly,
THEODORE COOPER.

EXHIBIT No. 73n.

August 31, 1907.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge Co.,
Quebec, Canada.

DEAR SIR,—Mr. Cooper has directed me to send to you the enclosed copies of letters and telegrams in regard to condition of chord joint 7-L and 8-L, south cantilever arm, Quebec bridge, etc., that all evidence in Mr. Cooper's possession will be in your hands, this in connection with Mr. McLure's letters, copies of which are in his possession.

Mr. Cooper takes the trouble very seriously, and is not in condition to write.

Yours very truly,
BERNT BERGER,
Asst. to Mr. Cooper.

EXHIBIT No. 73o.

Sept. 2, 1907.

MY DEAR MR. HOARE,—If I were a well man I feel it would be my duty to be with you, accepting all the responsibility of my position. But I know I should be of no use if there, as I could not stand the physical test.

I believe I can be of more use by staying here and keeping what strength is left me. There is nothing to be hidden in my position. Regardless of how it may affect me or my reputation, you shall have every assistance and any record or knowledge I have.

In my own depression I have not forgotten that sympathy is due to you all. May we get the truth regardless of whom it may affect. The cause of mankind is greater than any individual.

Yours sincerely,

THEODORE COOPER.

This is the first letter I have been able to write to any one.

EXHIBIT No. 73p.

Oct. 4, 1907.

Mr. C. SCHNEIDER,
Consulting Engineer,
Pennsylvania Building,
Philadelphia, Pa.

DEAR SIR,—Mr. Cooper has directed me to inform you that in addition to the instructions as to the wind strains laid down in Mr. Cooper's modifications of the load and strain specification for the Quebec bridge, he ordered, in a letter to Mr. P. L. Szlapka, of the Phœnix Bridge Company, dated June 13th, 1905, that for the cantilever arms the full wind on the suspended span should be considered, as a tornado might strike over this area.

Also, Mr. Cooper has made a note on his first copy of the modifications of strain and load specifications that he had directed that 1,600 lbs. of snow per foot of bridge should be used.

Yours very truly,

BERNT BERGER.

EXHIBIT No. 74a.

Feb. 4, 1901.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge Co.,
Quebec, Canada.

DEAR SIR,—I acknowledge receipt of your favour of Jan. 31st, giving us final elevation of viaduct piers, length of approach spans, etc., for your bridge, and we will arrange our diagrams and details accordingly. We hope to get off to you, either to-day or to-morrow, copies of these trial diagrams and estimates as you request, so that you can fix final units.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74b.

Feb. 25, 1901.

(Personal.)

DEAR MR. HOARE,—In checking over the proposed form of formal contract for the main structure at Quebec, we find some little trouble in meeting the wishes of your people and the requirements thrown around payments of subsidies. In work of this

magnitude it is not only usual, but necessary, to have arrangements made for *progress monthly* estimates, as we have outlined in our proposed form of agreement. Will you kindly advise me the present status of all subsidies, whether they are all operative and whether payments have been made for substructure under any or all of them; and if so, how and when these payments were made. Were they made on materials at quarry or at site, simply delivered or actually in place? Information of this kind will assist us. Please write me promptly, and oblige,

Yours,

JNO. STERLING DEANS.

Mr. E. A. HOARE,
Quebec, Canada.

EXHIBIT No. 74c.

March 26, 1901.

(Personal.)

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge Co.,
Quebec, Canada.

DEAR MR. HOARE,—I have your personal letter of March 22nd. Mr. Szlapka tells me that only yesterday, while working over the second or third plan for the short approach spans, he was discussing with one of his assistants the advisability of making these approach spans in one length as probably the most satisfactory solution, and we are therefore very glad to receive your letter on the same subject. Mr. Szlapka will prepare now a complete design and close estimate for making these approach spans in one length and will send same to you as soon as possible. It will of course, take a few days, and you will then have all the figures before you to come to a conclusion.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74e.

(Personal.)

May 11, 1901.

Mr. E. A. HOARE, Chief Engineer,
Quebec Bridge Company
Quebec, Canada.

DEAR MR. HOARE,—Mr. Szlaptka returned home yesterday and I was pleased to receive his report that he had agreed fully with you as to the length of both approaches and has all the necessary information to prepare stress sheets to submit to you for the government's approval. This will be done promptly and when these stress sheets are returned we understand that we are to prepare shop drawings and send same to Mr. Cooper for approval.

Mr. Szlaptka also reports that the caisson for the first main pier is rapidly nearing a stage when it will be launched and placed in position. In this connection I believe

you will agree with me that the work is of such magnitude and of such importance as to make it absolutely necessary that all parts of the work should be passed upon by an independent engineer of acknowledged great ability. This should be done without questioning the ability and the conscientiousness of the contractor and his engineers, which are in this instance conceited. We expect therefore that you will have all details of construction of the foundation work, both the caisson, pier and its final depth of foundation, all passed upon by your consulting engineer, Mr. Theo. Cooper, and I would thank you to send me plans of the caisson and pier as soon as they are approved by him. I do not think it is necessary to indicate to you the great importance of this latter, and as the caisson is nearing completion, if it has not already been attended to, it should be done at once.

Will you kindly let me hear from you on the subject and oblige,

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74g.

August 9, 1901.

(Personal.)

E. A. HORE, Esq., Chief Engineer,
Quebec Bridge Company,
Quebec, Canada.

Dear Mr. HOARE,—I have your letter of August 6 and am now trying to arrange to be in Quebec next Wednesday or Thursday, August 14th or 15th, and will remain until Saturday evening or Sunday evening.

I can see you on Thursday and Friday and Mr. Parent on Saturday.

While I do not specially care to take up the question of formal articles of agreement with Mr. Parent on this trip, I have prepared a revised copy to agree with the alterations suggested at our interview at the Waldorf last January and I beg to inclose you a copy, thinking you might wish to look it over and discuss same with me during my present trip. I also enclose extracts from three of our late important contracts, indicating the manner in which progress estimates are prepared. The case of the 'Brooklyn Bridge' and the contract with the 'United States Government at Rock Island' are particularly in line with present contract.

I am making trip at this time particularly to ascertain in detail how we are to prepare our estimates and how we are to be paid for the approach spans which we are just about constructing. If you can secure any information on this line in advance, it will probably give me more time to devote to other matters.

I am taking our Mr. Schenck with me, who will make the necessary sketches for preparing a perspective view of the completed bridge. We will wish to go out directly to the bride site, the day we arrive, to look over the Quebc side of the structure.

I am very sorry to learn of the illness of your daughter and trust she is much better. Hoping to see you soon and in good health,

I remain,
Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

SESSIONAL PAPER No. 154

EXHIBIT No. 74h.

August 23, 1901.

Mr. ULRIC BARTHE,
Secy. Quebec Bridge Company,
Quebec, Canada.

MY DEAR SIR,—At my last visit to Quebec and in the limited time which could be given me by your president, the Hon. S. M. Parent from his usually crowded time, I was advised that we should prepare our estimates for the approach spans we are constructing, the same as was done in the case of the anchorage metal, and further that we would be paid in the same manner through checks of Mr. M. P. Davis. Under this arrangement there will become due us on or about November 15, 1901, for the erection of one approach about $50,000, and as the south approach span cannot be erected during the present season, there will be due on or before January 15, 1902, for the delivery of the metal work of this approach span at site about $32,500. I send this understanding to you direct that you may verify same and also write us should there be any action to be taken on our part different from that outlined above.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74p.

October 22, 1902.

Mr. A. E. HOARE,
Quebec, Canada.

DEAR MR. HOARE,—Mr. Tretter has returned from Quebec and reports that foundation of south river pier has been passed upon by government engineer and consulting engineer, and pronounced satisfactory, and that pier is now being sealed up and completed. This must be a great relief to you and Mr. Davis as well as all others interested in this great enterprise. I have instructed our treasurer, Mr. Davis, to send bill for the north approach span at this time, thinking you would wish to place the amount in this month's estimate—thereby dividing the total amount which will be due us on completion of both approaches. We will arrange to complete both this season as that appears to be the better plan. Please write me at your convenience.

Yours truly,

JNO. STERLING DEANS.

EXHIBIT No. 74q.

December 1, 1902.

E. A. HOARE, Esq., Chief Engineer,
Quebec Bridge Company,
Quebec, Canada.

DEAR SIR,—Replying to your letter of Nov. 6, asking a 'reasonably close estimate for talking finances,' of the several items to complete your Quebec Bridge, these prices to be what we 'think will prevail during the present winter.'

Growing out of the necessities of construction and particularly of the requirements in the field work, it will be impossible to divide the work and order same ahead, in as many items as you suggest, and I have therefore divided the work into three principal items, and even this division will be disturbed somewhat, as a very considerable portion of the cantilever arms must be erected at the same time as the anchor arms in order to make the anchor arms self-supporting. I can, however, discuss this matter more in detail with you, when you come to New York with Mr. Parent.

Item No. 1—

2 anchor arms.
2 towers on main piers.
2 towers on anchor piers.
Floor for anchor arms.

29,742,000 lbs. Price	$1,475,900
Wooden floor for this item, including railing, screens bolts, etc.	51,732
Total	$1,527,632

Item No. 2—

2 cantilever arms.
Floor for same.

22,780,000 lbs.	$1,126,400
Wooden floor for this item, including railing, screens, bolts, etc.	40,500
Total	$1,166,900

Item No. 3.—

Suspended span.
Floor for same.

7,335,000 lbs. Price	$ 359,190
Wooden floor for this item, including railing, screens, bolts, &c.	24,300
Total	$ 383,490

NOTE.

Void: See letter Jan. 20, 1903.—D.

December 1, 1902.

E. A. HOARE, Esq.,
Chief Engineer.

In item No. 1, under the item of wooden floor, etc., we have included the wooden floor, etc., of the approach spans, as it would be necessary to put these floors in at the same time the anchor arm floors are put in place.

As far as change in price is concerned, there is nothing in sight in our particular business which would indicate that there will be any change in prices within the next year or eighteen months—this is about as far as one can see ahead; certainly they will not be lower ; unless there is some great financial disturbance which cannot be foreseen. General business, and particularly the railways, are prosperous, as indicated by their increased earnings, beyond any previous record.

As far as I can learn from those best informed, everyone looks to next year as a year which will show, if anything, increased prosperity and business, and this is my own opinion.

As I have frequently expressed to you, it seems to me there is no time so well suited to launch a large enterprise as a time of activity, with business on a sound basis and a prospect of a continuance of these conditions. It is true that possibly your company might be called upon to pay slightly increased price for metal at such times, but this would be much more than offset by the ease in making your financial arrangements.

On the present basis, this increase in price of metal is only some $150,000 above the original figures. The remaining portion of increase in total price is due to the fact that we are now providing two sidewalks over the entire bridge at your request, and this appears to us to be a wise conclusion; and further, we are using the increased loads you mentioned in arriving at the sections of the floor system. These items of sidewalks and specifications increase the original estimate about 10 per cent.

One hesitates necessarily to discuss the future and I do not wish to be a party to mislead you or the people you represent in any way, but I firmly believe that nothing but a financial crash, which no one can foresee, and of which we have no evidence whatever at present, can affect the great prosperity now existing for at least eighteen months.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

P.S.—Please advise me early whether you will wish to discuss this matter with me in New York or in Philadelphia and time when you expect to reach either place. I am often away, as you know, and should have this information as long in advance as possible. I trust we will see you soon.

J. S. D.

EXHIBIT No. 74r.

May 20, 1903.

THEO. COOPER, ESQ.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We return herewith, by registered mail, your proposed specifications for loading and unit stresses, main span Quebec bridge.

I wish to make the following remarks in reference to these specifications.

1st. I assume that only one engine E—40 will be used on each railway track.

2nd. I find that the proposed 48,000 lbs. on two axles 10 ft. centre to centre on trolley stringers produce larger bending moment in centre than the 40,000 lbs. on two axles 7 ft. apart centre to centre originally used.

3rd. E-33 on each railroad track to be used for chords and main diagonals for the suspended span, is equivalent to 4,200 lbs. per lin. ft. on one track and almost 2,000 lbs. per lin. ft. on the second track.

4th. I tried formulæ proposed for main members and find in each case there will be a slight saving of material and that the unit stresses come within the limit of about $\frac{1}{10}$ of the elastic limit for live and dead load stresses.

5th. On page two of your specifications there should be added the same remark as on page 3 written *by you in pencil* and marked by me with red *asterisk.*

6th. I examined the values of the permissible unit stresses for reversed strains and I find in some cases there are slight errors, as indicated by me in red.

After you have these specifications rewritten and printed complete, I would be glad once more to have the opportunity of looking over them before they are sent to Canada for adoption.

Yours respectfully,

THE PHŒNIX BRIDGE CO.,

Per P. L. SZLAPKA.

P.S.—I have retained a copy of your papers.

EXHIBIT No. 74s.

May 22, 1903.

Mr. THEO. COOPER, ESQ., C.E.,
35 Broadway, New York, N.Y.

DEAR MR. COOPER,—I returned from Ottawa yesterday and you will be pleased to learn there is every evidence to believe that the programme as outlined by Mr. Parent in your office recently, will be carried out.

I was requested by the Ottawa officials to urge upon you to act as promptly as possible in the matter of completing the specifications and to forward same to Mr. Hoare without delay. There is urgent necessity of their taking prompt action. Will you kindly write Mr. Hoare when he may expect to receive copy of the revised specifications.

I will stop and see you the next time I am in New York, which will undoubtedly be within a few days, and give you more details.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74t.

May 28, 1903.

THEO. COOPER, Esq.,
Consulting Engineer,
Quebec Bridge Company,
35 Broadway, New York, N.Y.

DEAR SIR,—We were very sorry to learn by Mr. Berger's letter of May 25th that the grippe had hold of you, and trust by this time you have been able to knock it off.

Mr. Szlaptka has carefully examined the proposed revised specifications as to loads and strains Quebec bridge and same is returned herewith, with several notes in red, which we will believe you will add as agreeing with original understanding.

We would further suggest, that the last clause under the head of 'Future Increase of Railroad Live Load,' be added immediately after the live load clauses and before the wind clause.

As you undoubtedly well appreciate, it will be necessary for you to explain to Mr. Hoare, how the live load proposed in these specifications will easily take care of any possible increase in live load without overstraining the material. I know personally that Mr. Hoare and his people feel that the bridge should be designed to provide for a considerably heavier load than originally intended.

SESSIONAL PAPER No. 154

It has occurred to us that it might be well to add after the second paragraph in live load clause, the following:—'This loading being equivalent to engine E-40 with train load of 4,000 lbs. per lin. ft. on one track and engine E-40 with train load of 2,000 lbs. per lin. ft. on other track.' We simply make this to you as a suggestion, that parties examining specifications, may have it directly before them, that ample provision is made for heavy loading.

We notice you omit to add that the workmanship and material is to be in accordance with 'Cooper's specifications.' Please add this clause:—

Knowing the people in Canada are very anxious to have the matter settled, we understand you will forward to Mr. Hoare at once these revised specifications. Kindly send a copy to us.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74u.

June 15, 1903.

E. A. HOARE, Esq.,
Chief Engineer,
Quebec Bridge Co.,
Quebec, Canada.

DEAR MR. HOARE,—I received your letter of June 13th this morning and felt that we should not attempt to explain in detail the working of Mr. Cooper's revised specifications. He had his own reasons why these specifications should be adopted, and while we are acquainted with his views and approve of same, we believe the explanation should come from him, and especially so, as he wrote you direct on the subject and did not send the specifications or letter through this office.

I think you should see Mr. Cooper in New York or have Mr. Cooper meet you in Ottawa. If it is attempted to conclude this matter by correspondence it will certainly take a long time.

Mr. Parent should know, that we are not able to make a move until the question of specification is clearly and definitely settled and approved by the government. I have no doubt that Sir Wilfrid Laurier thinks we are working on our final stress sheet and details now.

You know I will be glad to assist personally in having these revised specifications approved and clearly explained to Mr. Douglass, but think it should be done in connection with Mr. Cooper. I will not advise Mr. Cooper that I have heard from you on the subject, but will be prepared to meet you in New York or elsewhere upon advice that you have arranged with Mr. Cooper for such a meeting.

I am glad that the Bill for making the Bridge & Railway Co. one, has been passed. Does this affect our contract—should the name of the party to the contract, with whom we have our agreement, be changed?

I notice the grant will come up shortly and I trust it will be on the lines of guarantee of the principal and interest of necessary bonds, as was proposed in our last visit to Ottawa.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74v.

July 24, 1903.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge Co.,
Quebec, Canada.

DEAR SIR,—We acknowledge receipt of your favour of July 22, enclosing a letter from Mr. Fitzpatrick to Mr. Parent advising that order in council was passed July 16th giving Mr. Cooper the necessary authority to act as required by you in your letter to Mr. Schreiber.

We have no doubt you have advised Mr. Cooper and he will immediately send us his instructions with copy of his modified specifications.

As I advised you yesterday by wire, we have started work on the floor and when we receive the above advice from Mr. Cooper, will be in full swing on the details of the entire bridge.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

P.S.—Please send me by return mail plan showing exact distance centre to centre of main piers and exact *elevation* of all main bridge seats, as determined since the construction of the piers.

(Signed) J. S. D.

EXHIBIT No. 74w.

July 31, 1903.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge Co.,
Quebec, Canada.

DEAR MR. HOARE,—I was greatly exercised this morning upon receiving a letter from Mr. Cooper under date of July 30th, stating that he had received from Mr. Schreiber copy of the 'Order in Council' and also a letter from Mr. Schreiber. In this letter Mr. Schreiber states he has asked for authority to employ a competent bridge engineer to examine from time to time the detail drawings of each part of the bridge as prepared and to *approve of or correct them* as to him may seem necessary, *submitting these for final acceptance* to the Chief Engineer of Railways and Canals. Mr. Schreiber further says, 'I have not yet named an *engineer in New York to consult with you,* but will do so without unnecessary delay and in the meantime I think you may safely go to work on the plans.'

The seriousness of this action I have not the least doubt you will appreciate immediately. It leaves the entire matter 'up in the air' and much worse than the condition we were all trying to avoid—which was to save most important time and that when Cooper once aproved our designs and details it would be final and accepted by the department. This is why I understand you secured the 'Order in Council.' It practically brings all matters to a standstill as neither Mr. Cooper or ourselves would know where we stand until this new hand could be consulted with, and even then we would only know as each plan was passed upon.

I cannot impress upon you too strongly the necessity of taking immediate action to stop any such plan as suggested by Mr. Schreiber.

When you consider that the entire feeling and action of Mr. Cooper's was to save the Quebec Bridge Company needless expense, without the least sacrifice in the design

or efficiency of the structure, it has certainly proven a thankless task for all concerned, and unless this present action upon Mr. Schreiber's part is immediately stopped the entire business will be in a worse condition than if it had been left entirely alone.

I am trying to reach you by phone, as I appreciate the necessity of immediate action.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74x.

Sept. 22, 1903.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—Quebec Bridge Floor System—Replying to your letter of Sept. 18th in connection with bracing between flanges of trolley and highway stringers, we call your attention to the fact that the Quebec specifications require flanges to be supported at points twelve times the width. Dominion specifications fifteen times the width. Cooper, sixteen times the width. These requirements would necessitate bracing in present instance. Aside from this we are strongly of the opinion that this entire live load floor should be thoroughly braced in its entire width, to insure the least possible effect upon the trusses.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74y.

Sept. 26, 1903.

THEO. COOPER, Esq.,
Consulting Engineer,
35 Broadway, New York, N.Y.

DEAR SIR,—We have your letter of Sept. 25th and notice you have approved the detail of floor beam and also the detail of track stringers and bracing with modifications.

We do not wish to insist upon our own views in the matter of stringer bracing and will be glad to confer with you again on this subject, as we are interested in saving every pound of dead load possible, without injuring the efficiency of the structure. As soon as our estimating department has checked over your estimate of weights, we will confer with you again.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74z.

June 11, 1904.

THEO. COOPER, Esq.,
Consulting Engineer,
New York, N. Y.

DEAR SIR,—We send you herewith a blue print showing camber lengths of truss members of anchor arms—Quebec bridge.

In arranging lengths of track stringers, we have to be governed by the following consideration. As underscored in red, the panel lengths decrease about ⅛ in. due to live load on the central span, while the same panel lengths increase about 1/16 in. as due to the live load on anchor arm.

Providing expansion over floor beam 6 only, floor beam 5 would bend out 11/16 in. either way and floor beam 7 slightly less. We therefore are inclined to adopt the following arrangement.

Fix stringers at floor beam 1. Fix stringers at floor beam 2. Expand both stringers at floor beam 3. Fix both stringers at floor beam 4. Expand both stringers at floor beam 5. Fix both stringers at floor beam 6 and 7. Expand both stringers at floor beam 8. Fix both stringers at panels 9 and 10. Expand stringers at centre posts.

Please advise us at your earliest convenience which arrangement you prefer, viz.; the latter or the arrangement with one intermediate expansion only at floor beam 6 and oblige.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 74aa.

June 22, 1904.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Referring to the packing of eyebars I find that as far as we can see by hasty examination, there is no reason why you should not add a single bar in panels A & B as you suggest. In rearranging packing of eyebars, you of course are bearing in mind that the full width of the truss cannot exceed 5 ft. otherwise it will encroach on the clearance and further, that the width of lower chord and end posts are fixed and also the location of the ribs, which cannot be disturbed. I trust you will let us have your conclusions at an early date.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74bb.

July 13, 1904.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge & Ry. Co.,
Quebec, Can.

DEAR SIRS,—We sent you July 11th, five blue prints of stress sheet of anchor arm as approved by Mr. Cooper, for examination and approval by the government engineers.

On July 1st five copies of this stress sheet were sent to you erroneously instead of being sent to Mr. Cooper for his approval. Kindly have the drawings approved by Mr. Cooper handed to the engineers and destroy the copies previously sent.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 74cc.

July 13, 1904.

THE. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We send you herewith in duplicate plan showing variation between lower chords and stringers for different condition of loadings anchor arm, St. Lawrence river bridge. After looking more carefully over these additional stresses due to bending of floor beams on account of fixed ends of the stringers, we revised the points at which the stringers are fixed. We find that owing to a deflection of the lower floor beam of 1/64 in. the corresponding additional stress of the floor beam upper flange for one-half of the deflection amounts to 380 pounds. The maximum deflection of the upper flange of any of the plate floor beams on our plans being 3/64 in., the additional flange stress amounts to 1,140 lbs., or only about 8 per cent of the live and dead load stress, which is certainly permissible. We hope this rearrangement of the expansion of the stringers will be satisfactory to you and that you will approve our method of providing for same.

We send also you in duplicate shop drawings of stringers which were formerly approved by you, except the connections at ends.

We return to you one approved copy of end bottom chord erroneously returned to this office.

Yours truly,

THE PHOENIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 74dd.

August 9, 1904.

THEO. COOPER, ESQ.,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—I have your kind letter of August 6 in reference to increase of section of members 'TLooooo' and 'TBooooo' for combination of stresses due to dead load plus 1½ live load plus wind.

I will gladly comply with your request and will also apply the same combination to all other members to satisfy myself that the unit stresses are in proportion not higher than those on the two above-mentioned members.

Yours respectfully,

P. L. SZLAPKA.

EXHIBIT No. 74ff.

August 19, 1904.

E. A. HOARE, Esq.,
Chief Engineer,
Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—I have your letter of August 17 and have asked Mr. Norris for report on the analysis of iron ore and hope to enclose same with this letter. (Will be ready on Monday, August 22-4.)

It is very unfortunate there has been delay in our reaching our storage yard at Chaudiere—it congests the work at all points, and of course entails additional delays, which are most serious in the short time at our disposal. We will be prepared to enter the yard the moment connection is made.

Regarding forwarding plans to you, I notice you desire us to follow the advice of the advice of the post office o cials here and let the prints go out as second-class matter unsealed. We will allow this until we are further instructed by you. A number of prints go to you to-day for approval of government engineer.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74gg.

Sept. 5, 1904.

A. B. MILLIKEN,
St. Romuald, Province Quebec,
Canada.

See Mr. Hoare and give particular attention to hurry connection with Chaudiere yard. We must get relief at this point and get in shape to ship and store material.

JNO. STERLING DEANS,

EXHIBIT No. 74hh.

Sept. 6, 1904.

Mr. THEO. COOPER,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We send you in duplicate for your examination and approval drawings No. 21 and No. 25 and we send you five copies of drawing No. 1 for your siguature.

We send to you also a general plan and most of the typical drawings and connections of the steel traveller to be used in the erection of the superstructure for the Quebec bridge, the latter drawings are for your inspection and file.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 74ii.

Sept. 7, 1904.

A. B. MILLIKIN,
St. Romauld, P.Q.,
Canada.

Birks will reach Quebec Friday afternoon. I assume you can rent instruments from Hoare.

JNO. STERLING DEANS,

EXHIBIT No. 74jj.

Sept. 8, 1904.

Mr. E. A. HOARE,
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

DEAR SIR,—I have not received the copies of specifications for Quebec Bridge which you promised to send me for our records. Will you kindly send me three or four copies of same, and oblige,

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74kk.

Sept. 12, 1904.

Mr. E. A. HOARE,
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

DEAR SIR,—We send you herewith in duplicate complete calculations of the anchor arm, Quebec bridge, except the main posts and their bracing over the main piers which will be supplied later.

These two sets of calculations are for the use of the government engineer in checking our stress diagrams and need not be returned to this office.

We send these stress sheets in answer to your letter of August 22nd and in answer to Mr. L. K. Jones' letter of August 6, addressed to Ulric Barthe, secretary.

Yours truly,

THE PHOENIX BRIDGE COMPANY,
Per P. L. SZLAPKA.

EXHIBIT No. 74ll.

Sept. 19, 1904.

Mr. E. A. HOARE,
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

DEAR SIR,—Referring to your letter of Sept. 14th to our Mr. Szlapka we regret we have not completed the stress sheets of suspension span and cantilever arms, it being necessary to revise our present stress sheets to agree with the final details of the permanent structure and also details of the traveller. As soon as these stress sheets have been revised we will send you a duplicate set.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74nn.

October 8, 1904.

Mr. E. A. HOARE,
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

DEAR SIR,—We find we have not received from the government engineer the approval of any main chord sections. As explained to you some time ago we have been working at great disadvantage to ourselves in being compelled to confine our office work to the anchor arm, in order that everything might be done that it is possible to do, to be ready early next spring to start the erection of the anchor arm. There was too much work to do in the time allotted after the financial arrangements were made and work ordered ahead. We have not, therefore, been able to complete our stress sheets for the cantilever arm and for the suspended span, it being necessary to await the completion of all details, not only of the permanent structure, but also the details and rigging of the main traveller, that we may know exactly the total weight coming at each panel point.

We have, as you know, sent to the Canadian engineers, through your office, the stress sheets for the anchor arm, covering the chords which have not been approved, and we would kindly ask that they be examined and prints sent to us with their approval as soon as possible. The engineers have everything that is necessary to check these chords, although we thoroughly appreciate they would like to have before them these stress sheets of the entire bridge and these will be sent with the least possible delay.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

December 3, 1904.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR MR. HOARE,—I have not as yet received any copies of your printed specifications for the Quebec bridge. Will you kindly see that I receive two copies promptly, as they are necessary for our records.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 74oo.

Mr. T. P. SAGE.

Herewith find sketch in triplicate of centre post foot—C. O. 612, 613. Please advise if same can be shipped to storage yard.

C. E. C.

EXHIBIT No. 74rr.

Jan. 31, 1905.

Mr. THEO. COOPER,
Consulting Engineer,
New York, N.Y.

DEAR MR. COOPER,—Quebec Eyebars—I beg to enclose copy of record of interview in New York yesterday in connection with the additional tests which you require. I trust I have properly stated your wishes. If there is anything you desire to be added, please let me know. We are making the first test this afternoon and the others will be made as fast as bars can be prepared, and after all tests have been made and tabulated, we will make a full report to you.

I have just wired that Mr. Szlapka will be over to see you to-morrow.

I sincerely trust you feel much improved.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

January 31, 1905.

Interview with Mr. Theo. Cooper at his New York office, January 30, 1905, in connection with Eyebars, Quebec bridge.

For his additional information Mr. Cooper desires to have the following tests:

One test of Standard 15 in. bar, with pin hole bored ½ in. nearer the centre of bar, tested from 12,000 to 24,000 lbs. and note results and then test to destruction.

One test with pin hole bored 1 in. nearer centre of bar, tested from 12,000 to 24,000 lbs. and note results and then test to destruction.

One test of 15 in. bar with enlarged head, say 36 in. tested from 12,000 to 24,000 lbs. and note results and then test to destruction.

One test of 15 in. bar, 36 in. head, pin hole bored 1 in. nearer centre of bar, tested from 12,000 to 24,000 lbs. and note results, and then test to destruction.

One test of standard 15 in. bar, stressed to 24,000 lbs. per sq. in. and then load held on bar for a considerable time, say two hours, and note results and then test to destruction.

One test of any bar in stock, drift the pin hole ⅛ larger than bored, then shape pin hole to bear evenly on the semi-circumference of test pin, stress this bar to 24,000 lbs. per sq. in. and note result and then test bar to destruction.

(Sgd.) JNO STERLING DEANS.

P.S.—Both heads of bars to be tested to be laid off in in 2 in. squares from centre line and before making test.

J. S. D.

EXHIBIT No. 74ss.

February 2, 1905.

Interview with Mr. Theo. Cooper at his New York office, Jan. 30th, 1905, in connection with Eyebars, Quebec Bridge, and the modifications suggested by Mr. Cooper to Mr. P. L. Szlapka Feb. 1, 1905.

For his additional information, Mr. Cooper desires to have the following tests:

1. One 15 in. bar, with pin hole at one end only bored ½ in. nearer centre of bar, to be tested from 12,000 to 24,000 lbs. Note results, leave bar at 24,000 lbs. per sq. in. for say two hours in testing machine, then note results and finally test bar to destruction.

2. If moving pin hole ½ in. proves advantageous, test one bar with pin holes bored 1 in. and ½ in. nearer centre of bar from 12,000 to 24,000 lbs. Note results, etc. as above in No. 1. (If No. 1 gives no better results than pin hole bored in centre eye, then omit test No. 2.)

3. Test one 15 in. bar, with enlarged head, say 36 in. from 12,000 to 24,000 lbs. Note results, etc., as above in No. 1.

4. If No. 1 and No. 3 prove advantageous, test one 15 in. bar, 36 in. head, pin hole at one end only, bored 1 in. nearer centre of bar, from 12,000 to 24,000 lbs. Note results, etc., as above in No. 1. (If No. 1 and No. 3 do not improve eyebar, then omit test No. 4.)

One 15 in. bar, with pine holes bored in centre of eyes, to be tested as in No. 1.

6. In any bar in stock drift one pin hole ⅛ in. larger than bored, shape pin hole to bear evenly on the semi-circumference of test pin, and test bar as in No. 1.

7. Repeat No. 6 with 28,000 lbs. per sq. in. in machine for two hours.

JNO. STERLING DEANS,

P.S.—Both heads of bars to be tested, to be laid off in 2 in. squares from centre line.

EXHIBIT No. 74tt.

February 22, 1905.

F. B. NORRIS, Esq.,
Mgr. Phœnix Iron Company,
Phœnixville, Pa.

DEAR SIR,—In a letter received from Mr. Cooper to-day he refers to the tests on eyebars as follows:

'The results of the tests on eyebars are very gratifying.'

He would like, however, to have 'samples cut from the worst heads, viz.: 706 A and 705 B, and also from the better heads to see if they show any marked difference in 'heat indications.' Will you kindly have these samples cut from heads and carefully examined and let us have your report as soon as possible.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 75.

Extracts from letter books of the Phœnix Bridge Company, numbered from 64 to 77, inclusive, being prior to letter book 'No. 1, Quebec bridge.'

EXHIBIT No. 75a.

July 7, 1897.

E. A. HOARE, Esq.,
Quebec & Lake St. John Ry.,
Quebec, Canada.

MY DEAR SIR,—I did not have the pleasure of seeing you after our entertainment at Mr. Dobell's. I handed Mr. Dobell your letter and also had a very short conversation with him in connection with the bridge. He had the steamer run up to the site of the structure and invited a number of the prominent bridge engineers on the upper deck to do the work. I had previously talked with Mr. Theo. Cooper on the subject, so that he was posted, and should the matter take the form of our submitting a plan and estimate for the work, Mr. Cooper will be glad to pass upon these plans and give your people the benefit of his extended experience, I hope you will soon send me the necessary data to prepare figures.

Both Mrs. Deans and myself greatly enjoyed our trip to Quebec and are much indebted to you for your kind attentions.

JNO. STERLING DEANS.

EXHIBIT No. 75b.

November 8, 1897.

Personal.

Mr. E. A. HOARE,
Chief Engr., Quebec & Lake St. John Ry. Co.,
Quebec, Quebec.

DEAR SIR,—Replying to your letter of November 4, we are working on the plans now and I believe we will have all matters ready to refer to you by the latter part of this month. We are assuming that 1,600 ft, is the minimum span that should be used and will make the anchor spans of length called for by the most economical design.

For what purpose do you require the 'total loads on main pier and weight on anchor pier and top of bridge seat dimensions'? We could give you the weights at once, but thought possibly you might wish to have a complete design of the pier in order to arrive at clearances. We have intended to allow Sooysmith & Co., to design these piers after giving them exactly what we require for the metal work. If you will wire me, however, just what you wish the information for, I might be able to give what you require without referring same to Sooysmith & Co. For the present, at least, I think it much better to conduct all the correspondence with one party, therefore kindly send all your letters to me direct. I make this suggestion thinking possibly that you might write or wire Sooysmith & Co.

I am glad to learn that you have plans to suggest in connection with some construction company.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

P.S.—I will wire you should I go to Montreal within the next few days.

J. S. D.

EXHIBIT No. 75c.

November 30, 1897.

E. A. HOARE, Esq.,
Chief Engr., Q. & L. St. J. R.R. Co.,
Quebec, Quebec.

DEAR SIR,—Replying to your letter of November 27, we are making plan of bridge with straight chord, understanding that this is in accordance with the wishes of the government engineer, and from sketches we have made we believe it will also be the handsomest in appearance. Further, as the chord can only be curved for 100 ft. from each pier, there will be but little saving in cost; we will, however, be prepared to state just what this saving will be. We certainly do not believe there would be any saving which would warrant antagonizing the government in the least. It will be very important to ascertain, if possible, what 'our friend' makes the estimated cost, both for the straight chord and curved chord. Please try and have this information before meeting.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 75d.

April 14, 1899.

Personal and Private.
Mr. E. A. HOARE,
Chief Engr., Quebec Bridge Co.,
Quebec, Quebec.

DEAR MR. HOARE,—Mr. Szlapka and I were with Cooper the greater part of yesterday and you will be glad to learn there was not a single vital or important criticism or mistake found in our plans. All the slight differences, such as dead load anchor arms, reverse stresses in one or two members, thickness of some detail plates, &c., were all thoroughly discussed and satisfactorily settled and not a single one would *affect in any way our price or our proposition.* It was especially gratifying for us to learn this.

Mr. Cooper, however, somewhat upset me, by making the following remark which of course I understood was entirely personal and without any full knowledge of the situation. He said—'Well, Deans, I believe that all of the bids will probably overrun the amount which the Quebec Bridge Co. can raise and that the result will be as is usually the case that all of the bids will be thrown out and a new tender asked on revised specifications and plans.'

I told Mr. Cooper that while this might be the usual procedure that in the present case it was distinctly understood that whoever was the lowest bidder under the present specifications and plans would be awarded the work, *and if any modification were made their bid would be altered accordingly,* as this could readily be done to a conference with the bridge company's engineers and ourselves; as we could undoubtedly build as cheap a structure as any other company and that unless this plan was carried out as understood and agreed upon, the present bidders would be placed in a very unfair position after the expenditure of great time and expense.

I finally succeeded in convincing Mr. Cooper that this was the only fair method, but I think it will take the greatest care on our part to see that his report is not worded in such a way as to give the directors an opportunity of following this suggestion. Mr. Cooper undoubtedly desires to be perfectly fair, but not having been through this

whole matter like ourselves, does not fully understand the situation. I trust therefore that you will give his report the most careful scrutiny and get it in the right shape before it is submitted, as far as this suggestion is concerned. It would simply be just what our competitors and particularly the Dominion Bridge Company would like or the Union Bridge Company ,in fact, and I shall be much itnerested to hear from you on this point.

You have not advised me to whom I shall send the revised price of including delivery of the material from Quebec and Lévis to site.

Mr. Lindenthal and I have an appointment with Mr. Cooper next Tuesday to discuss the suspension plan.

Kindly advise me when you will desire the revised propositions of the suspension design.

I remain,
Yours truly,

JNO. STERLING DEANS.
Chief Engineer.

EXHIBIT No. 75e.

April 19, 1899.

(Personal.)
E. A. HOARE, Esq.,
Chief Engineer Quebec Bridge Co.,
Quebec, Que.

DEAR MR. HOARE,—I spent most of yesterday in New York in consultation with Mr. Cooper and Mr. Lindenthal, and found that Mr. Cooper had no serious complains to make in connection with Mr. Lindenthal's plan, in fact he expressed himself as much interested in the ingenious design.

It developed, however, in conversation, and Mr. Cooper so expressed himself to Mr. Lindenthal, that in view of the amount of the bid under his design, he would not give Mr. Lindenthal's plan careful and detailed consideration and would so report. This rather exasperated Mr. Lindenthal and for a time I feared he might withdraw his bid but it was smoothed over and I think will be permitted to stand. Mr. Lindenthal thought that Mr. Cooper should report solely and wholly *on the merits of the several designs,* without any regard to cost, and each design should have the same careful consideration, and that you and your company alone should consider the question of price. I know this is entirely different from Mr. Cooper's instructions, and that it would be useless to spend detailed investigation upon plans which are very expensive in price, but Mr. Lindenthal reviewed the matter from an engineer's standpoint, and having taken such unusual pains with the design and estimate felt that he was in a measure being slighted.

Mr. Cooper advises that he will finish about May 1st.

I think it of the utmost importance to see you some time before that date, and write to ask if you will not come to New York. Cooper also advised me that he had no authority to receive any revised bids for possible reduction in suspension bridge wire and I think this entirely proper. It seems to me, however, *that you should have all of these bids in your hands at once* and *I will be prepared to submit ours when you come to New York.*

Please let me know at once and by *wire* when you will be in New York.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 75g.

Sept. 14, 1899.

Hon. S. N PARENT,
President the Quebec Bridge Co.,
Quebec, Que.

MY DEAR SIR,—We have had repeated interviews with bankers. Drexel & Co., of Philadelphia, and they have evinced such an interest in the Quebec bridge, and the business has reached such a stage that we felt it necessary, in order to come to a final understanding, to have you meet them in Philadelphia to-day to discuss details, with which we were not familiar, and which it was necessary to discuss with some one in authority from your board. I therefore wired you asking for such an interview, and received reply from Montreal as follows:—

'Jno. Sterling Deans,—Just received telegram repeated by Secretary Barthe. If you think there is hope for understanding with bankers interview may be held Philadelphia Tuesday next if agreeable; will extend option accordingly. Meanwhile wire me Place Viger Hotel, Montreal, what banker desire, about the amount of bonds to issue, rate of interest and period of maturity of same.—S. N. PARENT.'

To this I replied as follows:—

'Hon. S. N. Parent, Montreal, Canada: As you could not attend meeting to-morrow, have arranged for meeting with bankers next Tuesday, September 19, understanding our option will be extended accordingly. Have written you details at Quebec. —JNO. STERLING DEANS.'

We had a meeting with Drexel & Co. yesterday and arranged for a meeting with you next Tuesday, September 19. We trust you can reach Philadelphia about noon on that day. If you will wire me the train you will take from New York, I will meet you at the station in Philadelphia and take you direct to our office at 410 Walnut street.

We understand from your message that our option is extended, in order that interview with bankers can take place and the details which will then be discussed finally considered.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 75h.

November 28, 1899.

Hon. S. N. PARENT,
President the Quebec Bridge Co.,
Quebec, Canada.

DEAR SIR,—As I wired you briefly this morning, we have been in communication with the bankers, both Drexel & Co., Philadelphia, and J. P. Morgan & Co., New York, and find there is no change in their original purpose to visit Quebec at the earliest possible date. Mr. Spencer, formerly the engineer and railroad expert of J. P. Morgan & Co., and now the president of the Southern Railway, was absent in the South when you had your interview with Mr. Coster in New York; he is still absent, but is expected home about December 1. You will agree with us that these bankers are undoubtedly the best and most reliable in the United States, and it appeared to us it would best conserve the interests of the Quebec Bridge Co., as well as our own, to deal strictly and solely with them; we have therefore made no effort to place the business elsewhere. It is quite impossible for concerns of this

magnitude to so arrange their varied interests as to permit important members to be absent for several days on short notice. We have not thought it wise to show any undue anxiety on our part or on the part of the Quebec Bridge Co., but have been constantly on the watch to urge prompt action where (when?) we thought it advisable. I appreciate fully the urgency, from your standpoint—but think the government should appreciate that through their insistence we lost at least two months' time and received a setback which has taken much labour and time to overcome. Considering the time our whole force has been at work we have accomplished considerable and I have no reason to change my opinion that if the business is left with us we will arrange to build your bridge in a satisfactory manner to all concerned. I am willing to go to Quebec or Ottawa with a representative of the Engineering Contract Co., and explain our present position more fully if you so desire. I trust you will find it possible to wait until Drexel & Co. visit Quebec. We can then decide immediately.

Yours truly,

JOHN STERLING DEANS.

EXHIBIT No. 75i.

(Personal). February 2, 1900.

DEAR MR. HOARE.—Yesterday Mr. Geo. B. Burbank, engineer of the National Contracting Company, called at our Philadelphia office. He stated he had just returned from Quebec, where he had spent a week in connection with the Quebec bridge. He said he had discussed the business with Mr. Parent, Price, Dobell and others; had dined with them, &c. Mr. Parent advised him that the Phœnix Bridge Company had the contract for the construction of the bridge, and he must see us. He appears to wish to assist in the financing and attend to the substructural part. Mr. Reeves thought possibly it would be advisable for me to make a trip to Quebec; in meantime I thought I would write you a personal letter and inquire whether Mr. Burbank made any special offer or suggestion, whether he is well known to any of the directors and whetner it would be advisable to cultivate him. Please write me a *personal* giving me any information you may obtain.

Yours, &c.,

JOHN STERLING DEANS.

EXHIBIT No. 75j.

(Letter headed Quebec Bridge Co.)

QUEBEC, April 21, 1900.

MR. J. S. DEANS,
Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—I am instructed to confirm you the telegram which was sent this morning by the president, as follows:—

'April 21st, 1900.

J. S. DEANS,
Phœnix Bridge Co.,
Phœnixville, Pa.

Agreement made in New York April 12th, approved by board. Proceed with plans immediately so as to enable us to order steel for anchorage piers upon approval

of same. Arrangements made with Davis. You can confer with Cooper and Hoare *re* plans.—(Signed) S. N. PARENT, Pres. Q. B. Co.

I also beg to enclose copy of resolution adopted by the board of directors this morning.

Yours truly,

ULRIC BARTHE,
Secretary.

EXHIBIT No. 75k.

April 14, 1900.

Hon. S. N. PARENT,
President, Quebec Bridge Co.,
Quebec, Canada.

DEAR SIR,—In view of the extreme importance of avoiding delay on your work, which we all appreciate, I write to ask you to kindly wire us when our recent agreement has been approved by your board and they have decided to order the metal work of anchorages.

We understand that in all engineering matters we are to receive our instructions from Mr. E. A. Hoare, your engineer, and that he works under authority from your board. Please advise if we are correct in this.

Further, we understand that all of our detailed plans of the structure, including sections, &c., must have the approval of Mr. Theo. Cooper, consulting engineer, 35 Broadway, New York, N.Y. Please advise us if we are correct in this.

I write you on these matters in advance of receiving your instructions to proceed, that there may not be the least delay in knowing how to proceed.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76.

Extracts from Phœnix Bridge Company's letter book No. 2, Quebec Bridge Company, February 23, 1905, to July 19, 1907.

EXHIBIT No. 76a.

July 8, 1905.

Mr. C. W. HUDSON,
Assistant Engineer, the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—We are sending to-day to Mr. Shoemaker complete instructions and plans for repairing the chord which was damaged in unloading at storage yard. You

will please read over carefully these instructions, and after becoming familiar with same explain to Mr. Hoare what we propose to do to put this chord in first class shape. You will please say to Mr. Hoare that both Mr. Szlapka and yourself have carefully looked into the matter, and when the repairs are made the chord will be entirely satisfactory. We have no doubt Mr. Hoare will have no objection to the method, but think best to have it explained to him in careful detail before the work is done.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76b.

July 21, 1905.

Mr. E. A. HOARE,
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—Mr. Szlapka saw Mr. Cooper yesterday, and he is entirely satisfied with our method of splicing angles of chord 9 in Chaudière yard, and I have to-day so advised our foreman and have instructed him to exercise care to see that the work is done in a thorough and careful manner.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76c.

July 21, 1905.

C. W. HUDSON, Esq.,
Assistant Engineer, the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—Referring to your letter of July 19, and that portion of it covering the handling of chords 7, 8 and 9. We have noticed that the lines in one position of handling bear against the strut, but have not figured that it was of very serious moment. We will be pleased to hear from you after you have looked into the matter further.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76h.

August 18, 1905.

A. B. MILLIKEN, Esq.,
Superintendent Erection, the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—Replying to your letter of August 16.

We wired you this morning, 'Upper connection plates for laterals not required at present. Fill two-thirds of the holes with bolts whenever possible.'

Please understand that while the anchor arm is supported by falsework, the lower laterals do not carry any wind stresses whatever, all these stresses travelling from trusses direct to wooden and steel falsework. It is, therefore, only a matter of convenient erection when you put these laterals in before you commence to erect the cantilever arms.

As regards the number of bolts for connections, we will not send you a diagram, as in all cases whenever possible it will be satisfactory to fill two-thirds of the holes with bolts. But in the connection of stringers to floorbeams this number should not be decreased, always remembering that the bolts when entered should only be driven so as to leave the *lower chord sections in their final camber position* without closing the gaps in chord sections shown on our erection diagram.

We understand that you will confer with Mr. Deans regarding elevations for north anchor arm falsework, and the advisability of having an outside party take these measurements.

We have advised Mr. Davis as regards return of check from Grand Trunk, forwarding Mr. Pullum's letter to him, with the request that same be returned to you.

Yours truly,

THE PHŒNIX BRIDGE CO.

EXHIBIT No. 76i.

QUEBEC, CANADA, 8-19-'05.

Hon. S. N. PARENT,
Pres. the Q.B. and Ry. Co.,
Quebec, Canada.

DEAR SIR,—The progress we are now making on the erection of permanent metal of the bridge is such, that it will reach a stage by the middle of next summer when it will be absolutely essential to the further progress of the work, we be ready to deliver material at storage yard, at grade, at north approach to the bridge.

To be able to do this it will be necessary that the short connection between the north end of bridge and the Canadian Pacific Railway be started immediately.

While the length of this connection is short, it involves much heavy work, which will take time to construct. The matter is so serious I have felt it necessary to bring it to your particular attention.

If this connection is not completed by the above time, say about July, 1906, it will undoubtedly result in delaying the completion of the bridge a year, and this will involve large interest charges and the disorganization of our forces, which would take months to get in efficient shape again.

I sincerely trust it will be possible to get the approach work under way at once.

I remain,
Sincerely yours,

J. S. DEANS.

EXHIBIT No. 76j.

(Telegram.)

QUEBEC, QUE., 10-24-'05.

J. S. DEANS.—Intended writing you about riveting lower chords anchor arm but overlooked it. Amended erection instructions from your office states that lower chords are to be riveted before work is carried beyond main pier; this is contrary to first instructions; it is a puzzle to us. We have referred it to Cooper. Please reply.

E. A. HOARE.

(Telegram.) October 25, 1905.

E. A. HOARE,
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

The field has authority to rivet chords when the bearing surface are in perfect contact.

JNO. STERLING DEANS,

EXHIBIT No. 76k.

Mr. E. A. HOARE, October 25, 1905.
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

DEAR SIR,—Confirming telegram of this morning as follows :—

The field has authority to rivet chords when the bearing surfaces are in perfect contact.'

You will readily appreciate that the action of the several sections composing the lower chords in the anchor arm, will fix the time when riveting can take place and when each pair of chords are in complete contact over the entire surface of the bearing, it will then be a proper time to do the riveting. We will have the opportunity of discussing this matter with you personally before any material amount of riveting is done and certainly before any riveting is done outside of the end horizontal chords.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76 l.

(Telegram.) ETCHEMIN, QUE., 11-22-'05.

JNO. S. DEANS,—We have closed this year's erection at 3 o'clock this p.m. by completing the erection of the third double panel of south anchor arm.

A. B. MILLIKEN.

EXHIBIT No. 76m.

Mr. E. A. HOARE, November 24, 1905.
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

DEAR SIR,—I beg to advise you that Mr. Cudworth has finally agreed to remain with us during the winter, we giving him a certain time off at the beginning and a certain time off at the end of the winter when you will have one of your representatives remain at site. This time will be arranged between Mr. Cudworth and your representative.

Mr. Milliken has wired me since my return to Phœnixville that the 6th panel of south anchor arm was erected, complete and the work stopped for the winter, on the afternoon of November 22. I know from your expressions to me, that you feel we worked as long as it was possible to conduct it with safety.

Since the approach reached the south side of the bridge on July 8, 1905, we have pushed the erection with all possible energy and have not been delayed by the want of any material, or the want of any labour. We, therefore, feel we have accomplished everything it was possible to do in the remaining portion of the season of 1905. What we did accomplish indicates clearly, that if we had had the full season for work, we could have erected, at least, this season, the metal work complete to the south main pier, including the centre posts, which was in accordance with our original programme for erection.

As I have written you before, I fear this delay will prevent us completing the south half of the entire structure next season, although we shall make an earnest effort to do this. If we do not accomplish it, as you undoubtedly understand, it will mean an additional working season at great additional expense to us, and of course additional expense to your company in interest charges, &c.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76n.

Hon. S. N. PARENT, November 24, 1905.
Chairman Transcontinental Railway Commission,
Ottawa, Canada.

DEAR SIR,—I was very sorry to miss you during my recent trip to Quebec. I desired particularly to talk with you in connection with the approach to the north side of the bridge. This is a most important matter. I have had no word from you since my letter on this subject of August 19, 1905. There should not be any delay in starting the construction of this north approach. I understand a portion of this approach will consist of a large metal viaduct, and I know from the present congested state of the metal market that it will need all the time between now and next summer to design, construct and erect this structure. Will you kindly advise me what progress is being made in this connection. I can call to see you at Ottawa to discuss the matter personally at any time you may name.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76p.

December 26, 1905.

E. A. HOARE, ESQ.
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR MR. HOARE.—Referring again to the north approach to the bridge and the metal viaduct which will be required, I desire to impress upon you the necessity of placing the order for this material. I know personally that all of the important bridge companies in the United States are sold out completely for 1906, and all of the steel mills are practically in the same condition. We have kept ourselves in control to take care of just such urgent pieces of construction. If you think there is any prospects of our doing the work, we should know it promptly. Will you kindly let me hear from you by return mail. When Mr. Davis was last here, here he asked me to send him a price, but I have not done this, as I wanted the matter to get into more definite shape.

Wishing you the compliments of the season,

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76s.

(Telegram.)

QUEBEC, February 10, 1906.

Mr. D. REEVES.

The Dominion government may call upon this company at any moment for the final estimates to complete the bridge over the St. Lawrence river, as a reorganization may take place very soon. Figures of this kind must be correct and cover everything required to complete the bridge ready for traffic, because after the next deal there will be no second opportunity to ask for funds. Your estimated weight of metal omitting the short end spans amounted to 29,736 tons, which figures were given to the government as being sufficient to cover the entire bridge, which at the time I thought insufficient. I was, however, assured that the figures were ample. To show that they were not I have already returned for payment over 29,000 tons, which do not include suspended span and some portions of cantilever arms. Will you please have this thoroughly investigated and the correct tonnage figured out to complete the bridge subdivided according to schedule prices.

E. A. HOARE.

For Mr. W. H. R. and P. B. Company—2/12/06.

EXHIBIT No. 76t.

February 17, 1906.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—As reported to you by Mr. Edwards, chord 8R on cantilever arm was faced at long end 7/64" out of square, so that while one rib is of the exact length, the other three are short, the outer rib being short 7/64".

There are two methods of correcting this error:—

1st.—We might reface the chord, so that the end will be square and the long section will be 7/64" short. This method would cause bending on the hanger to the amount of 7/64", as the stringers in this panel are fixed at both ends. The end of the cantilever arm would drop about ¼" owing to the short panel.

2nd.—We might reface the chord, making the section say ½" short, and replace this material by a filler securely doweled to each rib and to the exact shape of each rib. This would preserve the panel of the exact length.

I am inclined to believe that the second method is preferable, and if you agree with me, I will permit the shops to proceed with this method of correction. Please advise us as early as possible, as the shops are anxious to finally complete the chord.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 76u.

(Telegram.)

QUEBEC, Mar. 28/06.
Mr. DAVID REEVES—P. B. Company.

When will you be able to let me have the figures of the total weight of metal for Quebec bridge when finished, as requested in my letter of February 10? I fear I may be called upon any day for this information.

E. A. HOARE.

EXHIBIT No. 76v.

April 28, 1906.

Hon. S. N. PARENT,
President, Quebec Bridge and Railway Co.,
Care Transcontinental Railway Commission,
Ottawa, Canada.

DEAR SIR,—I understand the Cap Rouge viaduct has been finally awarded to the Dominion Bridge Company. I trust this contractor, and also the contractor for the rock-cut and grading on the approach to the bridge will be impressed with the great importance of the early completion of this approach. Unless it is put in shape to receive materials this year, it will undoubtedly mean a year's delay in the construction of the bridge. Our own field programme will be so seriously affected by the date of completion of this approach that it will be necessary for us to have a conference with you at an early date. If you do not find it possible to visit us in the meantime, I will arrange to see you, with our Mr. Milliken, about May 15. Kindly advise if you will be in Ottawa or Quebec at that time.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 76x.

(Telegram.)

June 8, 1906.

A. B. MILLIKEN,
Etchemin, Quebec, Canada.

Advise Mr. Scheidl to remain at bridge until centre posts fully connected. I assume you have come to agreement with him regarding riveting and discussed present elevation of panel points and open joints of all members as far as erected and the final plans for temporarily holding points at main strut connection, answer.

JNO. STERLING DEANS.

A. B. MILLIKEN,
Etchemin, Quebec, Canada.

Referring to Norris' personal letter to you, have drillings sent him immediately and match mark each package of drillings and rods so there will be no uncertainty about identification. Answer.

JNO. STERLING DEANS.

EXHIBIT No. 76y.

May 9, 1906.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—Field painting—I am rather surprised at your letter of May 7 in connection with painting. The matter has been referred to Mr. Milliken, and when we come to Quebec within the next week we will take the matter up and settle it properly at that time. I wish you would have your inspectors be prepared to point out in detail the parts which have not been cleaned and painted properly by our men.

Yours truly,

JNO. STERLING DEANS.
Chief Engineer.

EXHIBIT No. 77

Being a continuation of extracts from Phœnix Bridge Company's letter book No. 2, Quebec Bridge Company, covering the period from July 3, 1906, to January 2, 1907.

EXHIBIT No. 77a.

E. A. HOARE, Esq., July 3, 1906.
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

DEAR SIR,—Painting inaccessible parts—Replying to your letter of June 29th, as I understand the consulting engineer's wishes he desires that we arrange for those

parts of the work which are not readily accessible for hand-painting, a proper size hole to receive a nozzle of a paint spraying machine and this we will arrange to do. It would seem advisable not to locate this hole definitely until after the erection, as it can then surely be placed in the most desirable location. If your representative will keep a diagram, indicating at each point where a special provision for painting must be made and hand this diagram to our representative at site, it will surely receive attention and you may give yourself no further anxiety on this point.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77b.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge and Ry. Co.,
Quebec, Canada.

July 9, 1906.

DEAR SIR,—Yesterday, July 8th, was the anniversary of the completion of the track to the south end of the Quebec bridge, making it possible for us to deliver material and start the erection. We have therefore completed one full working season on the erection.

Last Saturday we had the complete south anchor arm erected, and the first panel of chords with the first story of web members in place in the cantilever arm ; demonstrating that our original estimate that the bridge could be erected in four full working seasons was correct.

The loss of the time up to July 8th of last year it is now plainly seen was very serious. We are hoping to make up for at least a portion of this loss, by using an additional traveller for erecting the last single panel of the south cantilever arm, and the south half of the suspended span. By using this additional traveller, although it means much additional cost to us, we will be able to be working on both sides of the river at the same time.

If we are able to keep our present program, we should have the south cantilever arm erected, with the exception of the last single panel, and the new traveller in place ready to erect the balance of the material, and the large traveller at least partly removed and transferred to north shore, before we are compelled to close down this season.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77c.

August, 20, 1906.

A. B. MILLIKEN, Esq.,
Supt. Erection, the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—Field corrections—I have your letter of August 17, and I quite agree with your criticisms in connection with the replies which you receive from these

reports. It is distinctly understood with the Engineering Department and your own department here, that each department must reply direct to the corrections for which they are directly responsible. You will have to allow for the next several weeks some delay in the engineering department in passing upon and replying to your field corrections. They will not eventually be neglected and they will be taken up in order and answered in detail, but now every moment of Mr. Scheidl's time is demanded by the urgency of the shop plans of the end of the cantilever arm and the small traveller. As soon as these are out of the way you will hear from all field corrections which have not been replied to. I trust this is satisfactory.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77d.

A. B. MILLIKEN, Esq., August 22, 1906.
Supt. Erection, the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—Steel bents—I am at last able to write you definitely in connection with the release of the first tower, or two complete bents adjoining the anchor pier. The designing office has carefully checked over the reactions from actual weights of members and find that these two complete bents may be removed when six single panels of cantilever arm are erected and the traveller standing in position ready to raise the 7th single panel.

We figure therefore that you will be able to take down these bents the latter part of September or early in October, provided you have reasonably good weather. It would appear therefore as if you could rush the work on the north shore. You will receive this advice as to the removal of the towers in the regular way from Mr. Scheidl, as a page in his blue print book of erection notes.

I send the above in advance for your information.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77e.

(Personal.) August 23, 1906.

E. A. HOARE, Esq.
Chief Engineer, Quebec Bridge & Ry. Co.,
Quebec, Canada.

DEAR MR. HOARE,—I thank you for your letter of August 15th, giving me some information in connection with the C.P.R. viaduct. I will look into this matter further.

Concerning our monthly estimates, the officials in Ottawa evidently do not clearly understand our contract. From an examination of the schedule in contract, it is quite clear that the item for *metal erected* meant metal erected and bolted. Th

last item *metal erected and painted complete,* means riveting and painting, finishing our contract.

The 15 cents or $3 per ton in this last item is more than sufficient to paint and rivet the entire structure.

When you bear in mind that we are now painting a very considerable portion of the structure and are also following up the riveting and are making no claim for either of these two items month by month, you will see that the government is amply protected and without any consideration of the reserve of $100,000, &c.

We cannot, therefore, accept this deduction of $1.50 per ton, as it would be a distinct departure from the terms of our contract.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77f.

August 23, 1906.

THEODORE COOPER Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Drawings sent you this morning for your examination and approval complete panel No. 9 cantilever arm, Quebec bridge. The writer will call on you in the course of the next few days to explain some of our details based on the different method of erection lately decided upon. As shown on one of our blue prints sent to you, we expect to take down the large traveller in its position on plan, and finish the remainder of the south half of the bridge with a small traveller, supported on the top chord. This small traveller is by far lighter than the large traveller, consequently the total stress in the two end upper panels of the cantilever arm are only 5,000,000 pounds instead of about 7,000,000 lbs., as originally shown on our stress sheet. This explanation will, no doubt, enable you to check our detailed drawings and return same with your approval.

Yours truly,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 77g.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge & Ry. Co.,
Quebec, Canada.

DEAR SIR,—Your letter of August 27th is scarcely reassuring. When we were last in Quebec we understood you to say that you were receiving reports from your inspectors weekly, indicating that the Dominion Bridge Company were receiving their materials regularly and satisfactorily, and that they had started the shop work. We had supposed with these reports before you, you could judge as to the progress which had been made and also as to the probable progress which would be made in the future. Your letter also does not advise that you have come to a definite con-

clusion in connection with the character of the foundations of Cap Rouge viaduct, and that the work on these foundations is actually under way. The trouble which you speak of in connection with the cement we assume refers to the pedestals of the viaduct and not to the river piers.

Will you not kindly advise us more in detail, so that our people will be better assured that the money which we are now expending will not be put out unnecessarily. Kindly let me hear from you promptly and oblige.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77h.

September 20, 1906.

A. B. MILLIKEN, ESQ.,
Supt. Erection The Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—Referring to your telegram advising that the blocking was still tight under trusses of anchor arm adjoining main river pier, we beg to advise that this condition is probably due to the fact that the points in general toward the anchor pier are low and this you will see has a tendency to increase the weights on bents adjoining the main river pier. It would be well to block up all points *toward anchor pier up to or even slightly above the elevations fixed for connection.* If this is done we believe you will find that the bent immediately adjoining the river pier has been released of its weight, even in the present condition of erection of the cantilever arm.

Please report promptly as possible.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77i.

September 21, 1906.

A. B. MILLIKEN, Esq.,
Superintendent Erection, the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—At the meeting in Philadelphia yesterday, I was requested by Mr. Reeves to ask you for a particular and detailed report in connection with the bolting of joints for trusses, laterals and floor. Mr. Reeves has felt that in view of the riveting being done at various points it is possible that some joints have not been left in the exact condition required by the instructions from the office. Will you therefore have Mr. Birks go over the joints, beginning with the anchor arm end of truss and up to and including last cantilever panel erected, and report in detail, that he has examined and found joints and connections bolted and riveted in exact accordance with the instructions of the office. Do not wait in sending this report until all connections have been examined, but make reports as fast as any complete panels have been inspected.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77j.

September 29, 1906.

A. B. MILLIKEN,
Etchemin, P.Q., Canada.

Blocking up falsework to fixed elevations will certainly release weight from steel bents ten, nine and eight, and, if so, they can be removed in order, and before bent seven is clear. This would advance your securing grillage, at least, ten days.

JNO. STERLING DEANS.

EXHIBIT No. 77k.

(Telegram.)

ETCHEMIN, QUE., October 3, 1906.

JOHN STERLING DEANS.

Bent ten clear of anchor arm; could not complete jacking to-day for releasing bent nine and eight; will wire to-morrow; hurry bridgemen here.

A. B. MILLIKEN.

EXHIBIT No. 77l.

(Telegram.)

ETCHEMIN, QUE., October 4, 1906.

A. B. MILLIKEN,
Quebec, Canada.

Remove camber plates from bents nine and eight until points swing clear; we think this will require about three-quarters inch more.

PHŒNIX B. C.

ETCHEMIN, QUE., October 4, 1906.

P. B. Co.

Bent ten free, nine and eight lowered three-eighths below grade elevation for erecting and are still very tight; shall we take out camber plates until trusses swing clear on bent nine and eight. Answer.

A. B. MILLIKEN.

EXHIBIT No. 77m.

October 6, 1906.

Mr. A. B. MILLIKEN,
Superintendent of Erection, the Phœnix Bridge Co.,
New Liverpool, P.Q., Canada.

DEAR SIR,—Mr. McLure has reported to Mr. Cooper some matters in connection with 'Up-3' post. He finds it bent out of line in one or two places. Mr. Edwards

learned of this through Mr. Cooper, and then wrote Mr. McLure to ask why the P. B. Co. did not report this matter to their office. Mr. McLure has written that, 'the P. B. Co. knew nothing about it.' It seems strange that any serious matter would be overlooked by our men, and we would like to have a report from you.

We are very much pleased to learn that panel points 10, 9 and 8 are swinging clear. We assume that you have a record of the amount of packing which you took out of these points before the truss swung clear. We wired you this morning, asking that you take the elevation of the lower chord points at these panel points, and also the leaning of the top main post, before the traveller is moved ahead. We think that this information, in connection with the amount of packing which was removed and your last field report, will give us some valuable information and probably be of advantage to us in arranging the blocking elevations on north side.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77n.

October 8, 1906.

A. B. MILLIKEN, Esq.,
Superintendent of Erection, the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—Replying to your letter of October 6, enclosing a communication to you from Mr. McLure of October 5, 1906.

I was not in the least surprised at your astonishment in receiving such a letter as the proposed supervision of your actions does not carry with it a single atom of responsibility.

The instructions sent from this office, which are referred to as the 'original instructions,' were decided upon, as you know, after the most careful consideration of each department of the company interested. We cannot hope in work of this unusual character to avoid the necessity of changing these 'original instructions.' I shall expect you to act upon instructions received from this office with the same alacrity and without question as you do on any other work in the field. In fact at Quebec it is even more necessary there should be only one source of these instructions.

If at any time you are doing what is not considered proper, the request for the change must come through Phœnixville. We know that Mr. Cooper did not intend that any instructions in connection with erection should be given to you from his office, and that his letter to Mr. McLure was simply giving his views and ideas as to how the work should proceed, which views were no doubt given in considerable detail, in view of Mr. McLure's lack of experience.

I return Mr. McLure's letter.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77o.

(Telegram.) October 16, 1906.

A. B. MILLIKEN,
Etchemin, P.Q., Canada.

'Relieve points four, five, six and seven, so they just bear, then relieve and remove tower adjoining anchor pier and report. Your letter thirteenth.—PHŒNIX BRIDGE CO.

EXHIBIT No. 77p.

October 22, 1906.

N. R. McLURE, ESQ.,
New Liverpool, P.Q., Canada.

DEAR SIR,—I am much pleased to receive your letter of October 17th.

The letter which Mr. Milliken forwarded to me was worded in such a manner as to lead Mr. Milliken to believe that you were giving him definite instructions and orders. I now see that this was not the case. It is our intention and desire that you should be posted as to every move which we make in connection with the erection of this bridge and that every facility be given you to make proper reports to your superiors, and I have never understood before, that you had experienced any trouble in securing this information and in being posted as to what we proposed to do. If at any time you feel you are not being properly advised, or have the least trouble in securing desired information, if you will kindly take up the matter with Mr. Milliken, I believe you will be entirely satisfied and secure what you desire. I expect to be in Quebec the latter part of this week and will be pleased to discuss the matter further with you.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77r

(Telegram.)

November 7, 1906.

B. A. YENSER,
Etchemin, P. Quebec,
Canada.

If bents four and five are not clear cut out blocking and lower them until they swing clear as soon you can spare men; answer.—JNO. STERLING DEANS.

(Telegram.)

November 7, 1906.

B. A. YENSER,
Etchemin, P. Quebec,
Canada.

Until cantilever arm is connected wire us every night progress made and condition work and weather; answer.—JNO. STERLING DEANS.

EXHIBIT No. 77s.

(Telegram.)

November 8, 1906.

B. A. YENSER,
Etchemin, P. Q., Canada.

Your message to-day lower panel points four and five to swing entirely clear.

PHŒNIX BRIDGE COMPANY.

SESSIONAL PAPER No. 154

ETCHEMIN, QUEBEC, 11-8-'06.

P. B. Co.

Panel points anchor arm four R and L and five L has a slight bearing; all other points are swinging clear; shall we lower points to swing entirely clear.—B. A. YENSER.

EXHIBIT No. 77t.

(Telegram.)

ETCHEMIN, QUE., November 12, 1906.

Phœnix Bridge Company.

Wind sixty miles east deflections P one cantilever post two inches west from normal.—B. A. YENSER.

EXHIBIT No. 77u.

(Statement.)

November 14, 1906.

On October 28, 1906, the undersigned visited Mr. E. A. Hoare, chief engineer Quebec Bridge and Railway Company, and discussed with him the probability of the north approach to bridge being ready to handle our metal in the early spring of 1907 as promised. He advised it was his opinion that the approach would not be ready until the latter part of 1907, and suggested that we see Mr. M. P. Davis, the contractor.

We then drove out to see Mr. M. P. Davis, and had a long talk with him on the subject, and he finally advised us that in his belief the masonry of Cap Rouge viaduct would not be ready before September 1, 1907, and after that date it would be necessary for the Dominion Bridge Company to erect the two towers and river span of this viaduct, and this would make the date when approach would be ready to handle our materials not earlier than October 15, 1907.

We expressed our sincere regret at this condition of affairs and advised him that it entirely upset our plans and would put us to much expense as we had been working toward starting the erection of the north anchor arm early in the spring of 1907, based on the promises made to us by himself and Mr. Parent that the north approach would be ready to handle materials not later than May 1, 1907. The present condition of our work was sufficient evidence that we were in a position to do this.

After leaving Mr. Davis we saw Mr. Hoare later in the evening and explained to him the result of our interview. We told him it would be necessary for some one to put the Phœnix Bridge Company right before Sir Wilfrid Laurier and Mr. Parent as we had given them our promise to exert every effort to complete the bridge in 1908, and had spared no expense to this end and were in a position to do so. Mr. Hoare expressed himself as entirely agreeing with us in this particular and that the delay would be one for which we were not responsible and he would have it clearly understood with above parties.

JNO. STERLING DEANS
A. B. MILLIKEN.

EXHIBIT No. 77v.

November 14, 1906.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—When last in Quebec you advised you expected to visit Phœnixville during the present month. As it is necessary for us to have a conference with you on several important matters, I write to ask when we may expect you here. Mr. Parent, you will remember, promised to make us a visit during this fall, and we trust he will be able to accompany you. It is specially desirable that he should see the present condition of our works here.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 77w.

(Telegram.
JOHN S. DEANS.

ETCHEMIN, QUE., November 26, 1906.

All metal panel no. one placed for this season removing (rigging) from traveller one lower section yet to remove bents eight and nine.

A. B. MILLIKEN.

EXHIBIT No. 77y.

December 27, 1906.

Mr. THEODORE COOPER,
Consulting Engineer,
New York, N.Y.

DEAR SIR,—We send you herewith in duplicate shop drawings of top chord section 'A' and of top laterals of the same panel.

The ties carrying the rails for the top chord traveller will be fastened to the top chord with hook bolts, so that no extra holes are necessary in the cover plates for any fastening of the track.

Kindly return one print with your approval, and oblige,

Yours truly,

THE PHŒNIX BRIDGE CO.
Per P. L. SZLAPKA.

EXHIBIT No. 77z.

January 2, 1907.

S. N. PARENT, Esq.,
President Quebec Bridge and Railway Co.,
Ottawa, Canada.

DEAR SIR,—Mr. Hoare left for home last Saturday, with full information as requested by you, covering the tonnage which must be temporarily stored near Belair

Your visit here will show to you the necessity of immediate action, and we ask that you will kindly wire us your instructions. After the receipt of your instructions it will take from one month to six weeks of earnest effort on our part to be ready to receive the material, and in the meantime the congestion here at our works is increasing.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78.

Extracts from Phœnix Bridge Company's letter-book No. 2, Quebec bridge, covering the period from January 2, 1907, to July 19, 1907.

EXHIBIT No. 78a.

(Telegram.)

January 18, 1907.

E. A. HOARE,
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

The statement you have covering cost of storing 6,000 tons we believe is under estimated, especially doing the work at this season. No material is included that can be used elsewhere. The intention being the Quebec Bridge Company is to pay only actual dead extra cost of this temporary storage. Would Tuesday afternoon be as convenient for meeting your committee as Monday afternoon? Answer quick.

JNO. STERLING DEANS.

EXHIBIT No. 78b.

March 6, 1907.

E. A. HOARE, Esq.,
Chief Engineer, the Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—We wired you yesterday as follows:—

'Weight of main bridge, 72,800,000 lbs., exclusive of anchorages. Anchorages weigh 2,200,000 lbs.'

This weight of course you will understand is exclusive of the weight of the small approach spans.

As the drawings are practically complete, and figured weights were made of nearly every member, the above should be very close to the actual total weight of the bridge, and this is the first time that we have been able to make such a close estimate. All estimates heretofore have been, as you understand, simply estimated weights made before details were prepared and drawings approved by your consulting engineer.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78c.

(Telegram.)

RUSH—RUSH.

March 18, 1907.

THEO. COOPER,
Consulting Engineer,
45 Broadway, New York.

Mr. Szlapka will be in your office about 12.30 to-day with last drawing of Quebec —Hurrah.

JNO. STERLING DEANS.

EXHIBIT No. 77d.

March 18, 1907.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—Mr. Szlapka went to New York to-day and took with him for Mr. Theodore Cooper's approval the last drawing of the Quebec bridge. I firmly believe that few people appreciate what our engineering office has accomplished in connection with the detailing of the Quebec bridge. I believe you are among the few who *do* appreciate the magnitude of the work, and I also believe that you will be much interested in learning that the last drawing is now in the consulting engineer's hands.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78e.

March 19, 1907.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—We have arranged our programme for starting the work at Quebec, and Mr. Milliken will soon visit the site and determine when the work can actually begin. We will probably start the riveting first, and then follow with the removal of falsework on south side and the erection of the falsework on the north side, and later start the erection of the suspension span. We hope that the season will be such that we can make an early start.

We are all much interested in the progress which is being made on the Cap Rouge viaduct and the approach to the north end of the bridge. Will you not kindly advise us how this is progressing and when they expect to actually start on the caissons.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

SESSIONAL PAPER No. 154

EXHIBIT No. 78f.

April 3, 1907.

Mr. F. P. NORRIS,
Manager, Phœnix Iron Co.,
Phœnixville, Pa.

DEAR SIR,—At an interview with Mr. Theo. Cooper, consulting engineer, by Mr. Szlapka, Quebec bridge, on April 1, his permission was obtained to moderately heat the injured ends of the chord section No. 10 cantilever arm. Should it be found that this heating is necessary kindly arrange to have the heating and repairing of the chord done in the presence of Mr. Morris and the Quebec Bridge Company's inspectors so that favourable and complete report may be made to the consulting engineer about the method used in repairing the chord.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78g.

April 20, 1907.

A. B. MILLIKEN, Esq.,
Supt. of Erection, the Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—The time has arrived when I think some definite steps must be taken in connection with starting of the work at Quebec, and while there is still some uncertainty surrounding the actual dates when shipments will be completed, I think you can depend upon the following and you will please arrange accordingly.

I understand you will leave for Quebec next Tuesday, April 23, and on your way will stop to see Mr. MacMartin at Albany, inquiring particularly of him as to any new work which is coming up and also discuss with him the bridges on the Quebec Southern, for which we recently tendered.

As you were advised all the riveting can now be done at Quebec and it would seem advisable to start this part with full forces any time after May 1, making special arrangements with Mr. Barton for the power you require for this part of the work.

Noth side—The north side work may be started at any time the river and weather conditions permit.

You may expect the small traveller to be delivered to you complete not later than June 1, and you will please arrange your erection so as to be ready for it on that date. I do not think that you will be delayed after that date for the want of any material, either for the traveller or for the suspended span, and you will arrange your forces to push the work in the most economical manner.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

P.S.—Please note letter to Mr. Barton, Can. E. L. Co. of April 20-'07, attached hereto.—(Sgd.) J. S. D.

EXHIBIT No. 78i.

Mr. N. R. McLURE, April 30, 1907.
New Liverpool, P.Q., Canada.

DEAR MR. MCLURE,—I was very much interested and amused at your letter of April 28 in connection with the remarks made regarding Quebec bridge. It is in line with what we have heard from the beginning and I would not be surprised if there are many people in St. Romuald who would not care to walk over the bridge when finally connected until they had seen it carry trains safely for several weeks.

I suppose you have seen Mr. Milliken by this time and know that we will soon be organized and at work again.

I trust the season will keep open and pleasant.

With kind regards, I remain,
Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78j.

May 4, 1907.

A. B. MILLIKEN, Esq.,
Supt. Erection, the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—Field riveting—It has taken some time to carefully consider your message of May 2 in connection with riveting. You will bear in mind that the field report made by Mr. Birks at the close of last year's work, indicating that all joints were tight and that riveting could proceed. As a matter of fact the upper laterals and the lower laterals are about ⅛th from their normal relation under present conditions and to rivet up now would put an extra stress in these members. The main diagonals running from the top of the centre post are also not in their normal condition at present and should not be riveted. This question of riveting and also the great variety of details surrounding the adjustment panel we believe warrants sending Mr. Scheidl to Quebec and he will arrange to be there on May 14 or 15, when he will discuss with you and settle all these matters. We trust this will be satisfactory and enable you to arrange your work economically.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78k.

May 9, 1907.

E. A. HOARE, Esq.,
Chief Engineer, the Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—Replying to your recent letter in connection with prints for the approval of the government engineers, I beg to advise you that we are forwarding the

sets as fast as they are received and have the approval of the consulting engineer. You will understand that nothing has been constructed without the approval of the consulting engineer, but it takes some time after this original approval for the sets of prints, which foot up a large number, to receive the attention and signature of the consulting engineer. Immediately on receipt of your letter, we called up Mr. Cooper's office and urged upon them the importance of returning prints promptly, and advised him of the receipt of your letter on the subject. You will no doubt be receiving sets of prints promptly until the whole list is cleaned up.

For your personal use we are sending you to-day three copies each of anchor, cantilever arms and suspended span stress sheets. If there are any other prints which you specially desire, please advise.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78l.

May 20, 1907.

Mr. N. R. McLURE,
New Liverpool, P.Q., Canada.

DEAR SIR,—We have your letter of May 17 in connection with riveting. Mr. Scheidl's trip to Quebec has been delayed on account of not starting the erection of main material until about June 1. In the meantime full revised riveting instructions were sent to the field, and we supposed you had copies. If you have no copies please confer with Mr. Milliken or Mr. Yenser and they will show you their copies until your set arrives. I will also see that you have full sets of erection drawings sent promptly, particularly drawing (C.O. 621, 622, No. 120).* There are such enormous number of prints passing through at present, including seven sets of all for Mr. Hoare, that we are swamped temporarily.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

* Since writing above I find you receipted for this drawing on May 14, 1907, and I will send another copy to-day.—J. S. D.

EXHIBIT No. 78m.

(Telegram.)

QUEBEC, QUE., May 20, 1907.

J. S. DEANS,
Phœnix Bridge Co.

All plans must be according to contract submitted to government engineer for approvals before any work is done or estimate paid. Department complains that some of the plans are not submitted soon enough. Will write and explain.

E. A. HOARE.

EXHIBIT No. 78o.

May 24, 1907.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge and Railway Co.,
Quebec, Canada.

DEAR SIR,—I have your letter of May 21 in connection with delay in send-(ing) to you, for the department, the certified copies of approved plans.

I believe you understand that no material or finished work was included in any estimates that had not been approved by your consulting engineer, and you will remember that the consulting engineer, by order in council, was given the authority to make changes in specifications and finally approve plans, and we were advised to carry out the consulting engineer's instructions.

The Quebec Bridge and Railway Company have therefore paid no estimates for any work or material which was not finally approved by the consulting engineer, and we on our part have forwarded to you as promptly as possible the certified copies of plans as received from the consulting engineer.

We have been working so close to the actual field work, which, of course, could not under any circumstances be delayed, that it has been impossible to keep your principals supplied with prints as promptly as desired. We have made another urgent request on the consulting engineer to forward the remaining prints in his office, which now number about six hundred copies.

You have received certified copies for everything up to the detailed drawings of second main panel of suspended span, and you have received the approved stress sheet of this span.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78p.

May 31, 1907.

Mr. A. B. MILLIKEN,
Superintendent of Erection, the Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—Referring to the instructions given you last year, in connection with the touching up of painting at Quebec, you will please continue to act under these instructions during the present season, that is, you will please put in proper shape any poor shop-coating, or any parts which are rubbed off during erection, and which may be brought to your attention by the representatives of Mr. Hoare or Mr. Cooper. I understood, when discussing this matter with you, that you personally considered such painting necessary. If at any time you have any question of the necessity of correcting any particular painting as may be requested by above, you will please bring the matter to my attention.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

SESSIONAL PAPER No. 154

EXHIBIT No. 78q.

Hon. S. N. PARENT, May 31, 1907.
President, the Quebec Bridge and Ry. Co.,
Ottawa, Ont., Canada.

DEAR SIR,—We have just had a visit from Mr. Hoare, chief engineer, and among many other matters discussed with him, we took up the very important question of the north approach to the bridge.

We gathered from Mr. Hoare, as his best opinion, that we could not depend upon receiving material over this north approach via the Cap Rouge viaduct, to be of any service to us this year. Mr. Hoare suggested that possibly the Great Northern could have their connection completed much earlier, and, if so, the material for the north end of bridge could be delivered at our permanent yard via this line, in connection with the regular approach east of the Cap Rouge.

If we are to complete the erection of the metal work during the season of 1909, as now arranged, it is absolutely essential that material for erection be delivered at our permanent yard, near the north end of bridge, not later than September 1. 1907. We must erect, this season, the chords and main shoes for the north anchor arm, if we are to erect complete in 1909, and, even with the chords and pedestals erected this year, it will require two full and good seasons to carry out this plan.

We write you, not alone for the increased risk, anxiety and expense to us, which another working season would involve, but also owing to the serious effect on your interests growing out of another years delay.

Can you not do something to help this situation, and to insure delivery of the metal at our permanent yard by September 1?

I shall be glad to confer with you at any time or place in this connection.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78s.

B. A. YENSER, Esq., June, 15, 1907.
New Liverpool, P.Q., Canada.

DEAR SIR,—We have noticed in one or two of your reports reference to the sagging of bottom laterals anchor arm. We would like to have Mr. Birks look into this question and write us in detail concerning this sagging, why he thinks it occurs and how it is corrected.

Yours truly.

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78v.

Hon. S. N. PARENT, July 3, 1907.
President, Quebec Bridge & Railway Co.,
Ottawa, Canada.

DEAR SIR,—In accordance with my promise, I beg to give you below the results of my investigation in connection with the north approach to the Quebec bridge.

1st. We find no dependence can be placed on the Canadian Northern connection for service this year. We were advised that part of the right of way had not been secured, and their methods of working absolutely preclude any possibility of completing the connection before very late this year.

2nd. The connection between Belair and the bridge via Cap Rouge may possibly be completed this year, if the present programme of Mr. M. P. Davis can be carried out. (He expects to complete all substructure by August 15, 1907), and the Dominion Bridge Co. are instructed to increase their forces and duplicate their erection plant and keep close up to the foundations. If this latter is not done, the work on the approach will run over until next year.

3rd. We cannot hope to receive any benefit from north approach to the bridge this year, although this was necessary to absolutely insure the connection of bridge during the season of 1909. We will be ready to erect metal of north anchor arm by September 15, 1907, even working along moderately with our present forces. As we cannot bring material in over the north approach this year, it will be necessary for us to shut down on the north side and lose the two remaining months of present season.

4th. Under these circumstances the greatest effort must be put forth to absolutely complete line from Belair to bridge, ballasted ready to handle the heaviest loads this year, so that we may start erection the first favourable day of 1908.

5th. To insure every member being on the ground, preventing any possibility of delay, the entire north side must be delivered and stored at Belair this year. This will demand the increasing of the length of yard there, and we would like to have your formal instructions covering this extra expense for yard and the unloading and reloading of the material. The exact length of yard required, or the exact cost cannot be determined in advance—it will depend on how closely we can pack and store the material. We will do this extra work for actual net cost to us.

6th. The early part of next year, 1908, we must be given the use of track between Belair and bridge, so that we may temporarily operate our erection from Belair storage yard and have this track until our permanent yard, near the bridge, is in order.

Kindly let me have word from you promptly and oblige.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 78w.

July 6, 1907.

A. B. MILLIKEN, ESQ.,
Supt. Erection the Phœnix Bridge Co.,
Quebec, Canada.

DEAR SIR,—You will undoubtedly appreciate the feeling of Mr. Reeves when I explained to him the situation in connection with the completion of north approach. He still feels it quite uncertain whether we will get this approach finished this year or not and sees of course the very serious results to every one if it is further delayed. He specially requests that you do what you can to keep every one interested in this matter—Mr. Davis, Hoare, Dominion Bridge Co., and others and asks that you be able to report on your next trip to Phœnixville the exact situation and what we may expect. Please, therefore, see Mr. Hoare *just before you leave* and impress upon him the feelings of Mr. Reeves in this connection.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

SESSIONAL PAPER No. 154

EXHIBIT No. 78y.

July 12, 1907.

B. A. YENSER, Esq.,
New Liverpool, P.Q.,
Canada.

DEAR SIR,—Referring to your letter of July 5 where you speak of using 3,600 ram in driving the square pin between end floor beams of cantilever arm and suspended span. We assume that this trouble in driving was caused by a slight difference in the position of the two floor beams, and that when they are finally adjusted after the erection of the first panel, it will be found that expansion can take place readily at end of suspended span. Will you please have Mr. Birks examine this detail carefully and report.

We understand Mr. Cooper has been advised that the end pin holes of cantilever arm are ⅛" out of square, instead of being exactly in line as you reported. Please advise.

We also understand that Mr. Cooper has been advised that the cantilever arm deflected an additional 5 inches after the small traveller was erected. Please report on this.

We wired Mr. Milliken yesterday asking him to have Mr. Cudworth send us the revised print covering elevations promptly. We should have this information promptly after any new elevations are taken or any check elevations are taken. We certainly should have the information as early as Mr. Cooper, otherwise we cannot intelligently discuss the points which he raises from time to time.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79a.

July 24, 1907.

B. A. YENSER, Esq.,
New Liverpool, P.Q.,
Canada.

DEAR SIR,—Your letter July 22. Please advise Mr. Cudworth that 'full live load means 3,000 lbs. per lineal foot per track from anchorage to anchorage. No live load on the roadways or sidewalks.

Regarding specifications, it would be difficult for us to send Mr. Cudworth copy of the specifications, as there have been many modifications from the original. We will however, be glad to give him any information on any special point. Please have write us.

Yours truly,

JOHN STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79b.

July 26, 1907.

B. A. YENSER, Esq.,
New Liverpool, P.Q.,
Canada.

DEAR SIR,—Your letter of July 24 panel 'O' suspended span. We notice your remark that 'fully 50 per cent of holes in chord splices must be reamed before a ⅛"

bolt can be put in.' Will you please send us a diagram of the truss at this panel, showing which chord splices were found in this condition and also give us a little more in detail, if possible, the grouping of the holes which were bad. We must try to locate how this occurred to avoid such trouble in the future. Do the holes appear to be out of line in a vertical direction, or out of line in a horizontal direction or do they vary? Have you or Mr. Birks any idea how this might have occurred in the shop?

JOHN STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79c.

August 8, 1907.

Hon. S. N. PARENT, President,
The Quebec Bridge and Railway Co.,
Ottawa, Canada.

DEAR SIR,—Temparary storage yard, Belair, Que. In January last, when arrangements were made with your company for the temporary storage at Belair, of 6,000 to 7,000 tons of material to relieve the yards here and to advance your work, it was thought that the north approach to the bridge would be completed in October, enabling us to arrange our permanent yard near the bridge and store there the remaining material and particularly that portion of the work necessary for the first part of the season of 1908.

It is now evident that this approach, even if completed this year, will not be ready in time to transport any material to the permanent yard and even make a start toward carrying out the above programme.

To absolutely insure that there shall be no delay in the erection in the spring of 1908, it is essential that all of the remaining material at Phœnixville be shipped to Canada and safely stored in the temporary yard at Belair, in close proximity at the bridge site, and to arrange for this the present yard must be correspondingly extended immediately and we ask the authority of your board for the actual extra expense involved, as covered by vouchers which we would submit as per our present arrangement for the 5,000 to 7,000 tons.

It is needless for me to go into greater detail, as to the necessity of this action and what it means to both your company and to us if this great work, through further delays, is extended another season.

We may add the entire capacity of the present yard, 6,000 to 7,000 tons, has been shipped and nearly all of it has reached site and stored.

Asking that you give this matter the earliest possible attention, we remain,

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79e.

(Telegram.)

August 8, 1907.

A. D. MILLIKEN,
Etchemin, Quebec, Canada.

Mr. Cooper disapproves splicing joints lower chords 7 and 8 as proposed by Birks—have Szlapka look into this carefully.

PHŒNIX BRIDGE COMPANY.

SESSIONAL PAPER No. 154

EXHIBIT No. 79f.

(Telegram.)

August 8, 1907.

PHŒNIX BRIDGE COMPANY,—Method proposed at Quebec for splicing joints in lower 7 and 8 chords is not satisfactory. How did bend occur in both chords ?

THEO. COOPER.

EXHIBIT No. 79g

(Telegram.)

August 9, 1907.

THEODORE COOPER, Consulting Engineer,
45 Broadway, New York.

Mr. Szlapka happened to be at bridge site yesterday. Expect him home to-morrow with full information concerning chord joint. Will then write you fully.

JOHN STERLING DEANS.

EXHIBIT No. 79h.

August 9, 1907.

A. B. MILLIKEN, Esq.,
Supt. Erection, The Phœnix Bridge Company,
Quebec, Canada.

DEAR SIR,—In view of the conditions now at Quebec, you will probably have enough to attend to for the present, but having made the following notes, I record them for your information, as soon as you find the time and opportunity.

Main Traveller.—The removal of this traveller certainly has been much slower than you expected and I have no doubt Mr. Szlapka spoke to you regarding this when in Quebec.

End Adjustment.—We will be much interested to learn how the jacks work in making this adjustment—what trouble was found from the 'spring' of plates, etc.

Riveting.—For some reason the price of riveting has kept tie for the past week or two. Can this not be reduced?

North Side Shoes.—We assume Mr. Szlapka advised you that Canadian Pacific will not receive these shoes for shipment until certain bridges are renewed 'early in the spring.' We think this should be kept *private* for the present, as it might have some effect on the question of increasing the Belair yard. Have you any suggestion to make regarding handling these shoes from the river ?

Belair Yard.—We have now shipped about 6,500 tons of material to this yard and have made formal application to the Quebec Bridge Company, at the suggestion of Mr. Parent, for their authority to increase this yard to receive *all* the material at Phœnixville. As you have the opportunity, please urge upon Mr. Hoare and other officers of the company the necessity of this.

Elevations.—The advanced 'elevations' sent with field report, August 7th, for the panel points suspended span erected to date, agree very closely with office figures here, and you will hear from us again after Mr. Szlapka returns. The information sent was exactly what we require upon the erection of each panel point and in advance of the movement (illegible).

Yours truly,

JNO. STERLING DEANS.

EXHIBIT No. 79i.

August 10, 1907.

(Telegram.)
THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Splice cantilever chords 7 and 8.

Mr. Szlapka did not return to-day as expected, but will no doubt be here Monday, when we will write you at once.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79j.

August 12, 1907.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Chord splice, south cantilever arm, 7-L and 8-L.

Mr. Szlapka reached the office this morning, and I am able to give you information in connection with this one joint.

All ribs of the chord 7-L have a complete and full bearing on all ribs of 8-L. The bend was no doubt put in the rib in the shop before facing, and was probably done when pulling the ribs in line to make them agree with spacing of these ribs and the clearance between ribs called for on the drawing. The bend being on only one rib of one chord, there being a full bearing over the entire rib, all splice plates being readily put in position, we do not think it is necessary to put in the diaphragm suggested by our erection department.

Please let us hear from you promptly on this subject, and oblige,

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79k.

August 14, 1907.

B. A. YENSER, Esq.,
New Liverpool, P.Q.,
Canada.

DEAR SIR,—Enclosed please find copy of letter just received from Mr. Cooper in connection with bearings cantilever chord splice 7-L and 8-L, also our letter to Mr. Cooper of August 12th.

I wish you would have Mr. McClure and Mr. Birks examine this joint carefully and come to some understanding between themselves as to exactly the condition at this point. It is unfortunate that Mr. Cooper often receives quite different information from that reported to this office. I think it is quite necessary to avoid misunderstanding, that Mr. McClure and Mr. Birks understand each other before reports are made in future.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.....

SESSIONAL PAPER No. 154

EXHIBIT No. 79l.

August 14, 1907.

(Telegram.)

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Splice chord 7 and 8-L—your letter August 13th.

I will have a full and complete report made of this joint by Mr. McClure and Mr. Birks and submit it to you earliest possible moment.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79m.

August 16, 1907.

B. A. YENSER, Esq.,
New Liverpool, P.Q.,
Canada.

DEAR SIR,—Your letter of August 8th. Referring to your question as to whether diagonals T-5 and T-50, south side anchor and cantilever arms, may be riveted, we beg to advise that calculations have been made and it has been found that it will not be advisable to rivet these joints before the fifth panel of suspended span is erected complete. Of course, if any of the joints should be tight, either now or as erection progresses, they may then be riveted, but until the fifth panel is erected there is considerable tension in these diagonals.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79n.

August 20, 1907.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—We have advice from our field that you have received copy of sketch No. 28, giving further details in connection with cantilever chord splice 7-L and 8-L. You will notice that the two chords have a perfect bearing with each other at all ribs, both chords having one bent rib, and not one chord only, as we first understood.

Yours truly,

JNO. STERLING DEANS.
Chief Engineer.

EXHIBIT No. 79o.

August 23, 1907.

THEO. COOPER, Esq.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Joint 7-L and 8-L, south cantilever arm.

Referring to your letter of August 21st, I notice you expect to hear again from Mr. McClure. As soon as you have his report kindly let us hear from you again, and oblige,

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79p.

August 24, 1907.

Mr. F. P. NORRIS, Mgr.,
Phœnix Iron Company,
Phœnixville, Pa.

DEAR SIR,—Belair yard—up to August 23 there has been shipped to the north side about 14,100,000 lbs. This leaves about 22,000,000 lbs. remaining to be shipped. Can you not do something to hurry this out? South side now being finished, we sincerely hope you can do better on the north. Winter arrives early in Canada.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79q.

August 26, 1907.

B. A. YENSER, Esq.,
New Liverpool, P.Q.,
Canada.

DEAR SIR,—Referring to your field report, No. 19, we know you will be interested in learning the check figures of the office.

The field make the elevation—		Office.
bottom of P 1	average $19\frac{1}{8}$"	$18\frac{3}{4}$"
foot of T O O	average $25\frac{1}{8}$"	$24\frac{7}{16}$"

There must necessarily be some discrepancy between the office figures and the actual facts existing in the field. In the single case of weight of the wooden floors assumed by the office, at 1,500 lbs. per lin. ft, for entire floor. up to and including last panel erected, is no doubt too much and therefore it is natural that the office results should be lower than the actual figures found in the field. This all is a very satisfactory check.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

P.S.—We will not need any further measurements for longitudinal positions until we come to the centre post.

J. S. D.

SESSIONAL PAPER No. 154

EXHIBIT No. 79r.

August 27, 1907.

THEO. COOPER, ESQ.,
Consulting Engineer,
45 Broadway, New York, N.Y.

DEAR SIR,—Chords splice 7 and 8 cantilever arm south side.

Replying to your letter of August 26, I will have Mr. Szlapka call to see you first opportunity, to discuss this question. He will wire you later the day he will be in New York.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 79s.

ETCHEMIN, P.Q., CANADA, August 28, 1907.

(Telegram.)

PHŒNIX BRIDGE CO.,
Phœnixville, Pa.

McLure will call to-morrow to explain Birk's letter *re* anchor arm chord. Will see Cooper first.

E. A. HOARE.

EXHIBIT No. 79t.

(Telegram.)

August 29, 1907.

E. A. HOARE,
Chief Engineer, Q. B. Co.,
Quebec, Canada.

McLure has not reported here. The chords are in exact condition they left Phœnixville in and now have much less than maximum load.

JNO. STERLING DEANS.

EXHIBIT No. 79u.

(Telegram.)

1.12 p.m., August 29, 1907.

PHŒNIX BRIDGE CO.,
Phœnixville, Pa.

Add no more load to bridge till after due consideration of facts. McLure will be over at five (5) o'clock.

THEO. COOPER.

EXHIBIT No. 79z.

ETCHEMIN, P.Q., CANADA, August 30, 1907.

(Telegram.)

PHŒNIX BRIDGE CO.,

Entire anchor and cantilever arm collapsed at 5.30 this P.M. with workmen. Number lost unknown. Yenser, Birkes, Worley and Aderholt not accounted for. Work of rescue going ahead. Wickeizer in charge.

W. W. WAITNEIGHT.

EXHIBIT No. 79bb.

September 14, 1907.

F. T. DAVIS, Esq., Treas.,
The Phœnixville Bridge Company,
Philadelphia, Pa.

DEAR SIR,—We sent yesterday by the hand of Mr. Wm. H. Reeves a number of Quebec Bridge papers for the use of Mr. Barnes.

We understand from Mr. Reeves you have now in your safe the three blue print stress sheets. These blue prints are the original copies, signed by Mr. Cooper and the Canadian government and are very important records. Please see they are kept in good order and so you can lay your hands on them at any time, and oblige.

Yours truly,

THE PHOENIX BRIDGE CO.,
Per CHAS. E. CONNARD.

EXHIBIT No. 79cc.

(Telegram.)

QUEBEC, QUE., September 16, 1907.

CHARLES E. CONNARD,

Send me print of general plan attached to our contract, also look over correspondence and advise by letter when and how we were first advised original specifications would be modified.

JNO. STERLING DEANS.

EXHIBIT No. 79dd.

September 16, 1907.

Mr. JOHN STERLING DEANS:
Chief Engineer,
The Phœnix Bridge Company,
Quebec, Canada.

DEAR MR. DEANS.—I have your message to-day regarding 'when and how we were first advised original specifications would be modified.' Beg to state, Mr. Szlapka understood you had several conferences with Mr. Cooper in New York and he talked about changes in specifications and had given the matter considerable thought and he

requested you to ask Mr. Szlapka to meet Mr. Cooper in New York with any suggestions of his own. Mr. Szlapka went to New York on May 14th, 1903, where the question of specifications was further discussed and Mr. Szlapka secured a copy of changes in the specifications (6 pages) which Mr. Cooper had already prepared headed 'Specifications for loads and strain on Main Spans.' The final changes made by Mr. Cooper in the specifications are dated June 2nd, 1903. Later when the detail drawings were worked out and strain sheets prepared for trussed floor beams, a new clause was added to the specifications on March 2, 1904, giving unit stresses for trussed floor beams.

Regarding general plan attached to contract, we called Mr. Davis on 'phone and he advised no plan was attached to his contract and never had been.

From our records we find we sent to Mr. Hoare on October 12th, 1900, three sets of general plans correcting final 1 per cent grade and correcting length of approach spans and on October 25th, 1900, we sent one copy to Mr. Barthe.

We enclose herewith one copy of this plan No. 902 and the office here believe this is the copy attached to the contract, you will notice it calls for an 1,800 ft. span. Can you not get this confirmed from Mr. Hoare or Mr. Barthe.

In looking over our files we find we received a general plan of the 1,600 ft. span December 9th, 1898, which plan is dated Jan. 13th, 1898, and signed by Mr. Parent and Mr. Hoare.

Mrs. Deans is phoning you this evening and we will include a message.

Yours truly,

THE PHOENIX BRIDGE CO.,
Per CHAS. E. CONNARD.

EXHIBIT No. 79gg.

QUEBEC, CANADA, September 26, '07.

(Telegram.

P. L. SZLAPKA:

In case Mr. Deans forgets, please mail me immediately blue prints of calculations of strains, revised for the whole bridge. Those filed with government only for anchor and cantilever arms unrevised. Must have complete set immediately.

E. A. HOARE.

EXHIBIT No. 79hh.

(Telegram.)

September 27, 1907.

E. A. HOARE,
Chief Engineer,
Quebec Bridge & Rwy Co.,
Quebec, Canada.

Will send blue prints of calculations as soon as copies can be prepared.

THE PHŒNIX BRIDGE CO.

EXHIBIT No. 80a.

NEW YORK, January 26, 1905.

PHŒNIX BRIDGE COMPANY,
Phœnixville, Pa.

GENTLEMEN,—The tests showing the elongation of the eyes of eyebars under the usual working strains open up a very grave problem, upon the solution of which the interests of your company and of the Quebec Bridge Company are involved.

Before any decision can be made as to the proper future action, an exhaustive investigation of the whole question must be made. Best form and size of head to reduce this action to a minimum, how to insure uniformity of action of the different bars forming one set, &c.

Its solution has such an important bearing not only on the problem of the Quebec bridge but all future long spans, I feel that it would be wise to enlist the American Bridge Company to assist in the investigation and that I should have the aid of counsel (engineering) before a final decision can be had.

Yours very truly,

THEODORE COOPER.

EXHIBIT No. 80b.

January 28, 1905.

PHŒNIX BRIDGE COMPANY,
Phœnixville, Pa.

DEAR MR. DEANS,—Yours of 27th at hand. I am not able to come to Phœnixville nor in condition for serious work. If you could come over here I would like to have a little talk on the very serious question before us.

I hope you are not making any more eyebars for the Quebec bridge. I cannot accept any until this matter is fully investigated. The responsibility is too vast to proceed on the result of a few tests or without a full discussion. I think it would save much time if others were enlisted in the examination.

Yours very truly,

THEODORE COOPER.

EXHIBIT No. 80c.

To JOHN STERLING DEANS, Esq.,
Phœnixville, Pa.

NEW YORK, July 22, 1905.

MY DEAR DEANS,— If you come over here next week please come and see me. I want to talk over McLure's case. Unless Hoare comes down, I will have to depend upon your aid to get through his head the difference between an inspector for the erection and one for rivets. I would like to get this settled before sending McLure up there. My present physical condition will disable me from going to Quebec when any difficulty comes up, and I must have a technical man there who can make me know how things are.

Yours truly,

THEODORE COOPER.

EXHIBIT No. 80d.

NEW YORK, February 19, 1906.

P. L. SZLAPKA, Esq.,
Phœnixville Bridge Company,
Phœnixville, Pa.

DEAR SIR,—In reply to yours of 17th instant, I regret very much these errors.

The only remedy for the chord 8R seems to be the second method you propose. The dowels should be of such a character to ensure the plates from being loosened or damaged.

For that centre cap where all the pin holes have been bored too large, I see no satisfactory remedy but enlarged pins. The pin plates, to my surprise, have 20 per cent more pressure than the eyebars (should not have been so) and with the large holes, will make this the weakest joint in the structure, much to my regret. T50 also have reversed strains and the joints should be tight ones instead of being so free as now made.

Your very truly,

THEODORE COOPER.

EXHIBIT No. 80e.

(Letterhead of Quebec & Lake St. John Railway.)

QUEBEC, January 29, 1898.

(Personal.)

DEAR MR. DEANS,—I intended writing sooner but I was waiting for something definite to communicate. Matters have been dragging lately on account of some cross firing, but now they look more settled. There is more or less public opposition to overcome regarding the site, which until cleared away affects negotiations at Ottawa. The subsidy question is going to be pressed very hard sometime next month. The formation of a contracting company just at present does not meet with much favour until it is known when a subsidy can be expected. There is an important directors' meeting on Monday to decide upon future action respecting certain attitudes towards the main object. If I see things going right it might be well for you to make an offer in the form of a construction company, taking bonds as you suggested, conditional upon the acquisition of a certain fixed subsidy. I could send you a traffic statement in this connection. I am sorry I was ignorant of your presence in Montreal the other day. I left the Windsor in the morning and remained down town all day and your telegram was not forwarded. Will you please return all my pencil sketches and blue prints when you have done with them. I don't want to have anything in use of that kind in case he return to the charge. I think he has found out that I am the stumbling block or thorn in his side. We have an ice jam here from the bridge site down to the island about 10 miles long. If you happen to be in Montreal it might be a reward to see it. It will hang on for a few months.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80f.

(Letterhead of Quebec Bridge Company.)

QUEBEC, December 12, 1898.

Mr. JOHN STERLING DEANS,
Chief Engineer, Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—I have the honour to acknowledge receipt of yours dated 9th instant in which you express some surprise at the two months' extension of time given to tenderers on our proposed bridge. I beg to state that this decision was arrived at in the absence of Mr. Hoare, our engineer, who had some conversation with you on the subject, and as mentioned in my letter of 3rd instant, on special request from different firms. However, your objection to such delaying will be submitted to the directors at their meeting.

Your respectfully,

ULRIC BARTHE,
Secretary.

EXHIBIT No. 80g.

(Letterhead of Quebec and Lake St. John Railway.)

QUEBEC, March 2, 1898.

DEAR MR. DEANS,—In reply to your note I am able to state positively that your tender was last received, all others were in the evening of your arrival. Johnson has left, he was waiting for a plan from Montreal. The board meets to-morrow afternoon. I expect to be in New York next Thursday. I am not quite positive about it.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80j.

(Letterhead Quebec Bridge Company.)

QUEBEC, March 31 (no year).

(Personal.)

DEAR MR. DEANS.—Can you arrange to meet Mr. Parent and myself on Tuesday, 10th April, at New York, and in meantime if we find we can't go will you be prepared to come on here for that day? Some steps must be taken to commence work this summer on Quebec bridge piers, and before doing so it is necessary to talk over matters with you *only*.. No substructure people need appear for the present. The meeting could be more of a private nature with yourself.

Yours truly,

E. A. HOARE.

Reply by wire.

EXHIBIT No. 80k.

(Letterhead of Great Northern Railway Company and Quebec and Lake St. John Railway Company.)

(Private.)

QUEBEC, September 11, 1900.

DEAR MR. DEANS,—Will you please send the figures for maximum uplift for our anchor piers, so that I can check weight of masonry against it and say I have done so? If you could also send me the statement of formula showing a brief way to that end, and thus save book research, I shall be much obliged. Davis makes odd remarks (this is private) about the pier being smaller than that required for the shorter span, and says, I don't understand why it should *be so*. I should like to show him figures, as he says if the pier tips up it is not our fault, and so on. I don't want to bore Mr. Cooper with this, but your system can stand it after a trip to Europe.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80 l.

(Letterhead Quebec Bridge Company.)

December 7 (no year).

(Rec'd December 10, 1900.)

DEAR MR. DEANS,—Mr. Barthe has had a lot of domestic trouble lately, having lost his wife and mother the same week in his home, in consequence he finds it necessary to go away for a couple of weeks. Before he returns he may spend a day in Phœnixville to see your shops and steel works. He will let you know if he can manage it. Impress him all you can in connection with your working capacity, and if he refers to my trip to New York connect it with the contract and future orders. No election fights here, all going one side. Don't forget to send Davis the verses you showed me. Nothing new at present. Will you send me a sketch as you did for uplift weight, showing the load on bed plates of main piers and the way you arrived at the figures for my own satisfaction, and oblige,

Yours truly,

E. A. HOARE.

EXHIBIT No. 80m.

(Telegram.)

QUEBEC, January 15, 1902.

F. T. DAVIS, Treas.,
Phœnix Bridge Company.

Please draw on M. P. Davis, Quebec Bank, Ottawa, for sixty-seven thousand one hundred twenty-three ($67,123) dollars at site (sight) on Quebec Bridge Company's account. Draft will be honoured.

ULRIC BARTHE,
Sec'y, Quebec Bridge Company.

EXHIBIT No. 80o.

(Letterhead Quebec Bridge Company.)

QUEBEC, June 13, 1903.

(Private.)

DEAR DEANS,—I filed Cooper's amended specification in Ottawa last Wednesday. Mr. Schreiber immediately referred it to Douglas. He does not go into details personally. I have received a curious epistle from the latter this morning. To avoid annoying Mr. Cooper on account of Douglas, could you send me an approximate strain diagram showing relation of wind, live and dead loads on members, to allow Douglas to judge of changes proposed in unit stresses? He also wishes to know the sq. ft. pressures of wind used to arrive at Cooper's lin. ft. wind loads. He wants to know if it was taken from some standard or established practice on some large bridge already built or building. He wants its origin and examples. You no doubt have Cooper's amended specification (which, remember, does not replace the original beyond the clauses affected by it), and by reference to it you could no doubt supply Douglas with the above without Cooper's knowledge. If I can satisfy Douglas with information through you in this way it may save a rumpus, but if not I shall have to use unpleasant pressure.

Please also show me the comparison between Cooper's new column formula and Gordon's in my original using same unit stresses in each. Douglass suggests it. I am so engaged with other matters I cannot go into it in time. You can more readily do it. Douglass wrote a wild sort of a letter, just clear enough for me, but utterly unintelligible to an outsider. The company's bill making bridge and railway companies, *one* has passed. The grant will come up shortly. Your contracts have not arrived, unless sent to Mr. Parent who is absent till Monday. In haste.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80p.

(Telegram.)

August 3, 1903.

E. A. HOARE,
Chief Engineer on Quebec (Bridge) Co.,
Quebec, Canada.

I found Cooper had written and wired you and feels much more strongly than I do the serious result of any such action. It would be disastrous to have proposed appointment finally made. You and I should see Schreiber in Ottawa at once and come to some better understanding. As it now stands nothing can be done on plans. Answer to Phœnixville.

JNO. STERLING DEANS.

EXHIBIT No. 80p (2).

NEW YORK, August 4, 1903.

E. A. HOARE, Esq.,
Chief Engineer, Quebec Bridge,
Quebec, Canada.

DEAR SIR,—It seems to me that the entanglement in which we now find ourselves is largely due to a misunderstanding as to my desire to abbreviate the customary cir-

cumlocation in reference to the approval of plans for the Quebec bridge. It has not been my desire or intention, in any manner, to avoid or render perfunctory the supervision of the government authorities.

Many months of serious study must be given to the preparation of the plans before any work can be done towards ordering the material. As these plans develop the empirical rules (detail specifications) which apply to ordinary bridges must be modified to adapt them to a work of this magnitude. As the larger part of the rules in existing specifications are taken from my specifications, I know their inapplicability, unmodified, to a structure of this magnitude. A liberal excess of strength in the details of an ordinary bridge is judicious, but when this is applied proportionally to an 1,800 ft. span, it becomes onerous, and unnecessarily increases the cost and difficulties of construction. As the various members of this bridge will exceed anything heretofore made and will tax to the utmost the manufacturing appliances of the time, there should be given to the consulting engineer latitude to decide each case as it comes up with promptness. The work would be delayed beyond reason if each case must be discussed, and consent given beforehand.

I have no desire to reduce the efficiency of the bridge, but on the contrary I think the modifications I have suggested will be to the bettering of the structure.

My *chief* interest in this work is to obtain a work, which I can feel will crown my professional career of over forty years.

The changes I have suggested in the loadings will, in my opinion, increase the efficiency over that which would be obtained by a strict execution of the original contract.

The Dominion government will by no act of mine or with my consent get a structure in any manner inferior to the one they have a right to expect.

Neither do I see how the work can be carried out successfully or within a reasonable time unless trust and confidence be placed in some one consulting engineer, mutually acceptable to both the company and the government.

In the interest of the work, I am ready to withdraw, if the two parties can find some better engineer to meet this condition.

Yours very truly,

THEODORE COOPER.

EXHIBIT No. 80q.

(Letterhead of Quebec Bridge Company.)

QUEBEC, July 3, 190 .

(Rec'd July 6, 1903.)

DEAR DEANS,—I was in Ottawa last Tuesday and left with a promise that the specification will be attended to this week. I shall get my suggestion of having no government middlemen to interfere between Cooper and ourselves approved without a doubt. I have just arrived from the work and hasten to tell you that since the metal has been moved I find it horribly maltreated, no end of straightening to do, &c. One of the floor beams has been bent nearly the width of the flange in both directions and at the last rivet in the cover plate next to the flange angles, the upper leg of the latter has been cracked through as far as the rivet hole. I think the flange and webs can be straightened by loading and a narrow plate about 3 ft. long riveted under the flange to cover crack would answer the purpose, or extend cover plates and change lateral bracing connections. What do you think? As I am writing this off hand on my way home I have no detail plans handy for reference. But you can locate the place mentioned. Excuse haste.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80r.

(Letterhead of Quebec Bridge Company.)

QUEBEC, August 19, 190 .

(Rec'd Aug. 21, 1903.)

(Private.)

DEAR DEANS,—I have your letter of the 17th. Mr. S. is too old for the job and scared at his own shadow and that of the minister. Mr. Parent is absent. The chances are that no letter has come to hand so soon. You can do no more than follow the course outlined in your letter. I can't see why Mr. S. has not the courage to act independently, having authority to do so by council. I enclose a statement of spruce timber some of which may be suitable for wharfing. Timber is high here. The prices might be shaded a trifle. This timber is piled near St. Romuald wharf. While I think of it, my inspector incidentally tried some of the rivets in the north span and was able to turn them around with his fingers. I told him to inspect all important connections and report as soon as possible, as I have very little confidence in the whole outfit of last year.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80s.

OTTAWA, May 13, 1904.

SIR,—By direction, I return herewith, duly approved by the chief engineer of the department, two sets of the blue print plans marked 'U' 'V' and 'T,' respectively, sent in by you on the 7th inst., namely, of the anchor towers of the bridge of the Quebec Bridge and Railway Company, over the River St. Lawrence. The other set remains on file here.

I am, at the same time, to say that the plans in question are *detail drawings*, as are all others to which approval has been given (except the general design). The departmental general specifications for steel bridges require that a stress sheet of the entire structure should be submitted for approval, and that the stresses for dead and live load, wind, &c., for the various members of the trusses and towers should be indicated thereon.

I am to request that you will furnish this further information as early as possible.

I am sir,

Your obedient servant

L. K. JONES,

Secretary.

E. A. HOARE,
Chief Engineer, the Quebec Bridge and Ry. Co.,
Quebec, P.Q.

SESSIONAL PAPER No. 154

EXHIBIT No. 80t.

(Letterhead of Quebec Bridge and Railway Company.)

QUEBEC, September 14, 1904.

P. L. SZLAPKA, Esq.,
Phœnix Bridge Company.
Phœnixville, Pa.

DEAR SIR,—I received your letter of the 12th inst., also the two sets of stress sheets for anchor arm referred to. To complete the information required at Ottawa will you send duplicate stress sheets made in the same way for *suspension span for cantilever spans.* The government engineer at Ottawa requires a complete set of figures for his information. The second set is for myself for reference in communicating with him and for independent personal reference. Please let me have these immediately.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80u.

(Letterhead of Quebec Bridge and Railway Company.)

QUEBEC, September 19, 1904.

J. S. DEANS, Esq.,
Chief Engineer, Phœix Bridge Company,
Phœnixville, Pa.

DEAR SIR,—I have received this morning five prints of bottom chords for panel 2 of *anchor arms.* I have forwarded the same to Mr. Schreiber for approval, but I cannot get anything approved in connection with the trusses until I receive stress sheets asked for in my letter of the 14th inst. addressed to Mr. Szlapka.

Yours truly,

E. A HOARE.

EXHIBIT No. 80v.

(Letterhead of Quebec Bridge and Railway Company.)

QUEBEC, May 18th, 1905.

E. L. EDWARDS, Esq.,.
Inspector c/o Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—Answering your letter of May 15th respecting rolling of material ahead of plans approved, &c., for cantilever arms suspended span, particulars of which I mentioned to you when in Phœnixville last week, will you please see Mr. Cooper with Mr. Deans or with Mr. Szlapka, so as to come to an understanding as to the class and quantity of metal that can be rolled, inspected and accepted for monthly progress estimates. The understanding with me is that Mr. Deans or Mr. Szlapka is to get the necessary plans approved by Mr. Cooper before he can sign any more estimates for work outside of anchor arms, towers, and a limited quantity of plate metal agreed to for cantilever arms, and not to deliver metal for the cantilever arms or suspended span before the time required to prepare it for delivery in time for erection at the specified periods. Besides that Mr. Deans is to furnish me with plans

ahead of any material ordered, to be approved by the Chief Engineer of the Department of Railways and Canals of Canada.

The above must be complied with before any more material is estimated, outside of the anchor arms, towers and floor system.

See Mr. Cooper, that you may get instructions before the end of this month.

Yours truly,

(No Signature.)

EXHIBIT No. 80w.

(Letter Head Quebec Bridge & Railway Company.)

Quebec, June 15, 1905.

Messrs. THE PHŒNIX BRIDGE Co.,
Phœnixville, Pa.

DEAR SIRS,—I have received the calculations for the cantilever arms, a copy of which I immediately forwarded to Ottawa. I thought I had similar calculations for the suspended span, but cannot find them anywhere, and I do not think anything of the kind has been sent to Ottawa. Kindly send two sets as soon as convenient.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80x.

(Letter Head Quebec Bridge & Railway Company.)

(Personal.)

QUEBEC, July 9, 1906.

J. S. DEAN, Esq.,
Chief Engineer, Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—In answer to your letter of the 6th inst., nothing has been settled about the future of the bridge or the terminal railways. I cannot very well explain matters by writing but I do not consider we had a very good reception. In the meantime, however, they are going to back our notes for about six months longer to give time for a final deal. I am inclined to believe that our company will disappear.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80y.

(Letter Head Quebec Bridge & Railway Company.)

QUEBEC, August 9, 1906.

A. B. MILLIKEN, Esq.,
Supt. of Erection Quebec Bridge,
Care Phœnix Bridge Co.,
New Liverpool, Que.

DEAR SIR,—The Phœnix Bridge Company according to their contract are obliged to put a final coat on the approach spans, which I decided sometime ago to apply when

the whole bridge is being painted for the last time. In the meantime as the second coat was of such poor material, a large part of which has disappeared, it cannot be relied upon to protect the metal. Many places are bare, and rust has set in, which must be touched up this summer. When convenient, if you can send a man to do this work under the direction of Messrs. McLure and Kinloch, the company will pay for it.

Yours truly,

E. A. HOARE.

EXHIBIT No. 80z.

(Letter Head, The Commissioners of the Transcontinental Railway.)

QUEBEC, Oct. 20, 1906.

DEAR DEANS,—I wish to send you a few personal lines on the following matter. Mr. McLure showed me a letter dated October 5th, written by him to Mr. Milliken respecting the relieving of steel false work bents under anchor arm without giving him notice of such a procedure in order that Mr. Cooper first and then myself be previously notified. Mr. McLure has specific instructions to notify Mr. Cooper of any important procedure, and receive in return any instructions that may be necessary. I fancy changes were made from Phœnixville to relieve the false work. Mr. McLure —representing the Bridge Company's officers not daily on the work—should have been immediately informed notwithstanding the fact that you considered your instructions perfectly correct and safe. If Mr. McLure had been informed in time he could have wired Mr. Cooper your intentions without any delay to the work. I entirely endorse his letter to Mr. Milliken and to you on the subject of yours of the 8th inst. to Mr. Milliken.

Both you and Mr. Milliken appear to have misunderstood Mr. McLure's letter. He did not for a moment intend interference with erection orders from your office, but makes a plain request to be informed of important moves of the above nature, and not be ignored, in order that he may perform his duty and carry out his instructions. I regret your remarks on his lack of experience as it was uncalled for and is a reflection on the Bridge Company's supervision, and instead of helping matters the tendency will be to ignore general inspection orders which can be considered as given by me personally. Mr. McLure communicates daily with me and weekly with Mr. Cooper to receive instructions when necessary. I am writing you a personal and friendly letter which I hope will receive your usual generous consideration by seeing that Mr. McLure is better informed in future by your chief representative on the work of any proceedings of importance or of the nature referred to.

Yours truly,

E. A. HOARE.

EXHIBIT No. 81a.

(Letterhead Quebec Bridge & Railway Company.)

QUEBEC, March 20, 1907.

J. S. DEANS, Esq.,
Chief Engineer, Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—Your letter of the 18th instant received and I am very glad to hear that the last drawing is completed. (Will you please send me the usual five copies of

everything I have not received for final approval here, and if any back plans have been revised, please send substitutes also.)

I congratulate you on the successful completion of the office work and I fully realize the magnitude of the work required to detail the whole structure, having followed it from the beginning, and the satisfaction to you all to get this part of the work completed. (I regret that when I wanted to increase the quantities from the start you insisted that everything was provided for. Practically this cannot be avoided but it is a bad policy to underestimate, as I have been continually increasing my estimates from the start, which causes distrust in other quarters. I suppose, however, we will be able to worry it out.)

Yours truly,

E. A. HOARE.

EXHIBIT No. 81b.

(Letterhead of Quebec Bridge and Railway Company.)

QUEBEC, May 21, 1907.

J. S. DEANS, Esq.,
Chief Engineer, Phœnixville Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—Regarding the delay in sending plans here for approval for the department engineers at Ottawa, you must not be surprised if your estimates are held up until agreements are more carefully adhered to. The engineers at Ottawa have complained and are still complaining that the amended strain sheets and shop plans for a part of the cantilever and suspended spans have not been approved by the government in advance of work done and estimates paid. This should not continue any longer and I hope the plans will soon catch up to the work done and estimates paid. To state facts correctly you are already over paid a portion of your estimates, according to contracts. Personally I know that the situation is all right, but you must remember that no plans can be considered approved until certified copies have been received from Ottawa, and all the material paid for in Phœnixville and here, for a part of the cantilever arms and the suspended span should not have been estimated until the plans for the same were approved by the government. In other words you are getting a large sum in advance of what you should receive. This is a summary of the situation, which has been objected to because you do not send the plans to me in time to go to Ottawa before any work has commenced. It is only through my guarantee that I have been able to get any estimates passed at all for work represented by approved plans.

Yours truly,

E. A. HOARE.

EXHIBIT No. 81c.

(Letterhead of Quebec Bridge and Railway Company.)

QUEBEC, May 27, 1907.

J. S. DEANS, Esq.,
Chief Engineer, Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—In reply to your letter of the 24th instant, I am aware that you are doing everything that is possible to hasten the forwarding of the plans for approval

by the government except that much time might have been saved if Mr. Cooper had signed the *tracings* instead of having to sign so many blue prints.

The signature of the consulting engineer does not comply with the government regulations. The order in council passed some years ago only authorized certain modifications in the specification and details from time to time, if found necessary. The obligations under contracts, with the company and the government still remaining, viz.: that no work is to be proceeded with or estimates paid until the final plans have been passed through the various stages required by the government in the Department of Railways and Canals. This is the point they are objecting to. Understand that it is not myself that is raising any question, but I am only endeavouring to bring you in line with the contracts. The government has passed no order in council cancelling your obligation to have all your plans approved at Ottawa before any metal is fabricated. We are under very close investigation now.

Yours truly,

E. A. HOARE.

EXHIBIT No. 81d.

(Letterhead Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., August 6, 1907.

THE PHŒNIX BRIDGE COMPANY,
Phœnixville, Pa.

GENTLEMEN,—I enclose sketch of proposed diaphragm for splice between chords 7-L and 8-L of cantilever arm. One of the inside ribs is bent in at the bottom of the splice about ⅜ of an inch, the bend starting about 24" each side of splice.

We think that this was either in this condition when erected or was caused by this rib being slightly longer than the other ribs, which forced it to bend in when under stress. This is possible, as small bolts are used in bolting up the bottom splice plate. When this plate was removed for riveting the rib was found in its present condition.

The rib at the top of the splice is about ¼ inch out of line, but we do not think this requires any attention. If you approve of this diaphragm, please advise by wire and we will make it here.

Yours truly,

A. H. BIRKS.

EXHIBIT No. 81e

(Letterhead Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., August 16, 1907.

THE PHŒNIX BRIDGE COMPANY,
Phœnixville, Pa.

GENTLEMEN,—Referring to Mr. Deans' letter of the 12th inst. in regard to splice between chords 7-L and 8-L, cant. arm, Mr. McLure's first report on this splice was

similar to mine, but we to-day measured this point again, and the enclosed print of 'Sketch 28' will show you better its condition.

You will note that ribs CR of both chords is bent in at the splice, which was evidently not clear to you from my first report. The holes for rib CR in the bottom splice plate lie in a straight line, and a few of these holes near the splice point will not match well with the holes in the bottom angle of the rib. It can be determined better when this plate is fitted up whether or not it will require any exceptional drifting of the holes to insert bolts and rivets.

The top plate is at present connected to ribs GR and CL by means of ⅝" drift pins, and the holes are not distorted to any extent. All ribs of 7-L have a full bearing on those of 8-L.

Yours truly,

A. H. BIRKS.

P.S.—Mr. McLure is sending print of 'Sketch 28' to Mr. Cooper.

EXHIBIT No. 81f.

(Letterhead Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., August 27, 1907.

THE PHŒNIX BRIDGE COMPANY,
Phœnixville, Pa.

DEAR SIRS,—In connection with Mr. Yenser's letter on the same subject, I enclose sketches showing the amount the ribs of chords 9-L, anchor arm, and 8-R and 9-R, cantilever arm, are out of line. We are satisfied that chord 9-L, anch. arm, was not in this condition until recently. Its present condition was noticed for the first time to-day. We are not certain about 8-R and 9-R, cant. arm, as to whether the ribs have always been out of line or have buckled some since erection.

We have examined the lacing angles and they show no signs of buckling or distorting, and their connecting rivets show no signs of shearing. Chord 9-L, anch. arm, shows the greatest bending of the ribs. This is the chord that was repaired after receiving injuries in the storage yard.

Yours truly,

A. H. BIRKS.

P.S.—Sketch of 9-R, cant. arm, will follow.

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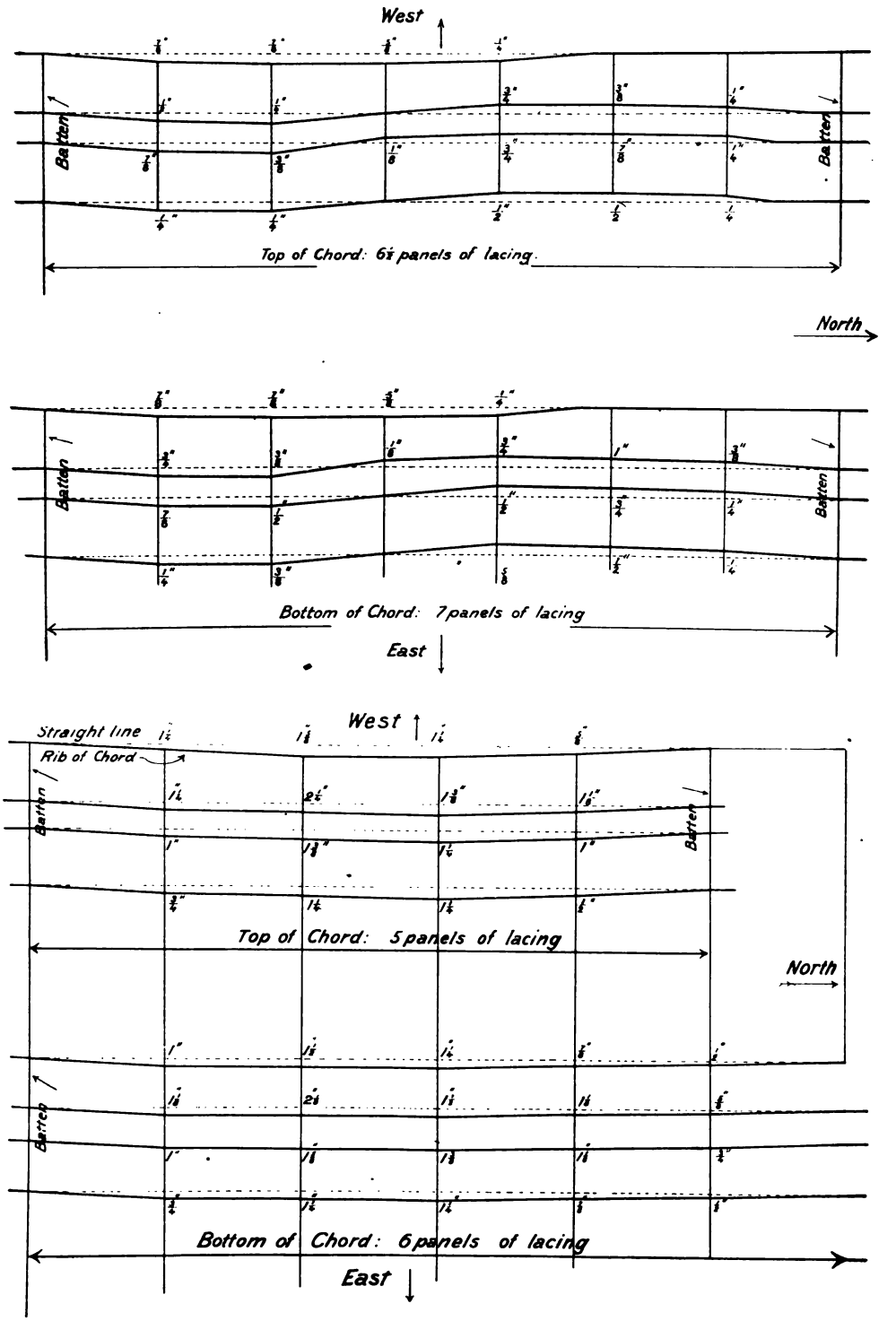


EXHIBIT No. 81g.

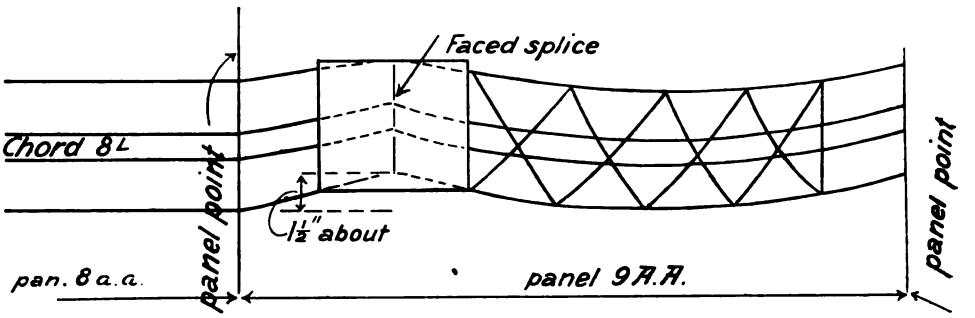
(Letterhead Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., August 28, 1907.
(Rec'd August 30, 1907.)

THE PHŒNIX BRIDGE COMPANY,
Phœnixville, Pa.

DEAR SIRS,—I have made a further investigation of chord 9-AA, and beg to report following additional data:—

The bend in the chord starts at the faced splice at the shore end and not at the edge of the splice batten. It appears from this that at least a large portion of the



bend was in the chord when the top and bottom splice battens were riveted early in June. This and the fact that the lacing angles are not distorted, leads me to believe that the ribs were bent before erection, in spite of the fact that Mr. Clark and Kinloch think all the ribs were straight when the chord was repaired.

From the evidence so far, I do not think we are justified in assuming it to be a fact that the ribs of any of the chords have buckled since erection, and Mr. Yenser has come to the same conclusion

Yours truly,

A. H. BIRKS.

EXHIBIT No. 81h.

(Leterhead Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., August 29, 1907.
(Rec'd Sept. 1, 1907.)

THE PHŒNIX BRIDGE COMPANY,
Mr. A. B. MILLIKEN, Supt. of Erection,
Phœnixville, Pa.

DEAR SIR,—Referring to talk over 'phone this morning, I told Mr. Hoare what you had to say regarding the bend in chord 9. He is entirely satisfied with the explanation, and is no longer concerned about the matter.

Referring to what you had to say about stopping erection, I fully appreciated from the first, the serious mistake we would make in taking this action, or in showing

that we were in the least concerned about the chord before it had been fully investigated and passed on by you.

Mr. McLure will explain to you the measurements we have made on the chords and we will check them as erection progresses.

Yours truly,

A. H. BIRKS.

EXHIBIT No. 81i.

(Letterhead of Quebec Bridge and Railway Company.)

QUEBEC, July 13, 1905.

J. S. DEANS, Esq.,
Chief Engineer, Phœnix Bridge Co.,
Phœnixville, Pa.

DEAR SIR,—Mr. Hudson has explained and shown to me the proposed reinforcements to broken chord A 9 L and in my opinion the reinforcements shown should make a very satisfactory job. I have instructed the resident inspector to thoroughly examine the chord to be sure that there is no other damage other than shown. As this is such an important member in the bridge *I think that Mr. Szlapka should see* Mr. Cooper and obtain his consent to the reinforcements proposed, for several reasons which it is not necessary now to mention.

Yours truly,

E. A. HOARE.

EXHIBIT No. 81j.

(Letterhead of Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., July 14, 1905.

THE PHŒNIX BRIDGE CO.,
Phœnixville, Pa.

GENTLEMEN,—In accordance with your letter of the 8th inst., I went to Quebec yesterday afternoon to see Mr. Hoare about the injured chord. After my explaining it to him, Mr. Hoare said he understood entirely what we intended to do and that he would allow us to repair the chord in the manner we proposed. Before our beginning the repairs, however, he wanted a report from his inspector, Mr. E. R. Kinlock, covering the extent of injury to the chord in order that he might be sure that we had found all breaks. I went over the chord this morning with Mr. Kinloch. After Mr. Kinlock examined the chord he reported by telephone to Mr. Hoare that the method of repairing the chord proposed by the Phœnix Bridge Co. would make it as strong or stronger than before, and Mr. Kinloch will confirm that verbal report to Mr. Hoare by a written one to-night. Mr. Hoare thought that as a matter of courtesy we should obtain Mr. Cooper's consent to our proposed repairs and he wrote you to that effect yesterday while I was in his office. As soon as you obtain Mr. Cooper's consent Mr. Shoemaker will begin the repairs.

Yours truly,

C. W. HUDSON.

EXHIBIT No. 81k.

(Letterhead of Phœnix Bridge Company.)

PHŒNIXVILLE, PA., July 21, 1905.

(Copy.

Mr. E. A. HOARE,
Chief Engineer, Quebec Bridge & Ry. Co.,
Quebec, Canada.

DEAR SIR,—Mr. Szlapka saw Mr. Cooper yesterday and he is entirely satisfied with our method of splicing angles of chord 9 in Chaudiere yard and I have to-day so advised our foreman and have instructed him to exercise care to see that the work is done in a thorough and careful manner.

Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

EXHIBIT No. 81l.

NEW LIVERPOOL, P.Q., August 30, 1905.

EXTRACT FROM LETTER.

THE PHŒNIX BRIDGE CO.,
Phœnixville, Pa.

GENTLEMEN,—Mr. Birks arrived on the work yesterday, Aug. 29, and I would also report that Mr. McLure is here in the interest of the Quebec Bridge & Ry. Co.

Yours truly,

W. H. SHOEMAKER.

EXHIBIT No. 81m.

QUEBEC, CANADA, September 26, 1907.

P. L. SZLAPKA.

In case Mr. Deans forgets please mail me immediately blue prints of calculations of strains, revised for the whole bridge. Those filed with government only for anchor and cantilever arms unrevised. Must have complete set immediately.

E. A. HOARE.

EXHIBIT No. 81n.

June 17, 1901.

E. A. HOARE, ESQ.,
Chief Eng'r. Quebec Bridge Co.,
Quebec, Que.

DEAR MR. HOARE,—I have your letter of June 14th, and have to-day sent copy to Mr. Cooper, with the request that he send us promptly his approval or suggestions in

connection with stress sheet of approach spans. As soon as we hear from Mr. Cooper we will start our detailed drawings. There is no time to lose now and we ask that you will stir up the government engineers and secure their approval to the plan that there may be no delay later on, on account of changes.

Referring to your personal letter of June 14th regarding width centre to centre of trusses main posts for channel span, we have never heard any criticism in connection with this width and in view of the fact that the matter has been carefully considered by Mr. Theo. Cooper and passed upon by him, it is unnecessary to take any serious notice of any criticism, which undoubtedly comes from a casual and incomplete knowledge of the conditions surrounding the design of a span of this magnitude.

I notice you will soon send us the detailed plans of the caissons together with copy of Mr. Cooper's letter approving same. We shall be much interested in learning of the successful launching of the caisson.

Yours truly,

JNO. S. DEANS,
Chief Engineer.

EXHIBIT No. 81o.

November 18, 1901.

E. A. HOARE, Esq.,
Chief Engineer Quebec Bridge Co.,
Quebec, Canada.

DEAR SIR,—I have a telegram from Mr. Milliken, stating that there is a heavy snow at Quebec, that he has conferred with yourself and Mr. Davis and that it seems impracticable to undertake the erection of north span this winter.

We have always feared this might be the case in view of the limited time between the date when Mr. Davis expected to entirely complete the approach work and be out of our road, viz.: Oct. 15th and the time that winter would set in. Mr. Davis was somewhat delayed in this work on the approaches, but the more serious matter was the longer time required to complete the main river pier, thus throwing the delivery of his material to the same time our own material should have been handled. We were as you know forced to use Mr. Davis' plant, both at bridge site and at Louise Basin, as all available room at site was necesarily occupied by him. We had a thorough understanding with Mr. Davis, but of course could not expect him to neglect his own work to handle ours, nor would it have been to the interest of the Quebec Bridge Co. to have had him do this, and we therefore find ourselves in the present situation, through no fault or neglect of our own, as full and complete arrangements were made in advance, by our superintendent of erection, Mr. A. B. Milliken.

I am trying to arrange to go to Quebec to-morrow, Tuesday afternoon, and will hope to see you there on Wednesday, but I write you this letter in advance, should I be delayed.

Concerning duty charges, this structure being practically a government bridge, it was assumed in our general discussion of the business that no duty whatever would be collected in connection with this construction, therefore a separate and distinct clause was put in our agreement, as you will see by referring to same, as follows: 'It is further understood that the party of the first part (Quebec Bridge Co.) shall pay *all customs duties and charges.*' This does not refer particularly to the metal work in the structure, *but to all such charges of every description.* We wrote to Mr. Barthe some time ago in connection with this duty, when the time came to pay certain charges on some of our plant, that we would pay these charges at that time if more convenient and add same to our estimates as presented. We have no doubt that the

entire amount will be refunded to the Quebec Bridge Co. and that they will be at no expense in connection therewith.

Yours truly,

JNO STERLING DEANS,
Chief Engineer.

EXHIBIT No. 81p.

December 2, 1901.

Mr. E. A. HOARE,
Chief Eng'r Quebec Bridge Co.,
Quebec, Canada.

DEAR SIR,—As per your recent letter and at the request of Mr. Deans, I send you herewith the estimated weights of main bridge, St. Lawrence River, Crossing, Quebec.

Suspended span	4,700,000
2 Cantilever arms	18,280,000
2 Anchor arms	19,150,000
Metal on piers	4,850,000
2 Anchorages	2,290,000
Floor for entire bridge	7,700,000
Main bridge	56,970,000

Respectfully,

THE PHŒNIX BRIDGE CO.,
Per P. L. SZLAPKA.

EXHIBIT No. 81q.

(Letterhead of Quebec Bridge and Railway Company.)

QUEBEC, June 14, 1907.

(Received June 17, 1907.)

J. S. DEANS, Esq.,
Chief Engineer, Phœnix Bridge Company.,
Phœnixville, Pa.

DEAR SIR,—I have your telegram of even date asking for reply to your message of the 12th, and replied as follows :—

'Your message was answered the same day *to Philadelphia* 'repeating by letter.''

The following is the answer I sent to your message of the 12th :—

'Auditor finished here but will have to wait Mr. Parent's return from Winnipeg next week before will have definite information *re* payments due.'

Yours truly,

E. A. HOARE.

SESSIONAL PAPER No. 154

EXHIBIT No. 82.

Extracts from correspondence of erection department, Phœnix Bridge Company, furnished by Mr. Milliken.

EXHIBIT No. 82a.

(Letterhead of Phœnix Bridge Company.)

NEW LIVERPOOL, QUE., CANADA,
October 19, 1906.

SOUTH SIDE.

THE PHŒNIX BRIDGE COMPANY,
Phœnixville, Pa.

GENTLEMEN,—Work was resumed this morning after being suspended, except the removal of crane-runway at the storage yard, all of yesterday, 'Thanksgiving Day. Notice of this suspension was sent you in the following wire message under date of the 18th instant, viz. : 'All work suspended in observance of Thanksgiving Day.'

The work of removing the spacing blocks from the top chord and diagonal bars cantilever arm, has been completed except on the up-stream side of panels No. 7 and No. 6, which is now going ahead.

All attachments, suspension rods (temporary), erection struts, &c., have been removed as far as the cantilever arm has been erected.

Floor beam 'F-4,' panel No. 4, is swinging in the falls, preparatory to its erection in place, while the floor is being removed from the lower forward overhang of the traveller. One (1) span of the girders carrying the supply tracks has been taken out, the other is hooked onto.

The removal of the traveller track stringers from the falsework of the approach span continues. Panels No. 10, No. 9 and No. 1 are removed, and those from the down-stream side of panel No. 6.

A force is at work removing the shims from panel points Nos. 4, 5, 6 and 7, so that they just bear on the falsework. We found after removing all the shims from point No. 6, up-stream side, that the point still bore very heavily. This will necessitate the removal of the top course of the wooden camber blocking and replace it with enough material to give the point an easy bearing. Point No. 7, up and down-stream sides, has had the shims removed so that it now just bears, point No. 6, down-stream side, likewise. In order to release point No. 6, down-stream side, so that the wooden camber blocking can be removed, it will be necessary to jack up points No. 7 and No. 5. This work is now going ahead.

The usual work continues at the storage yard. Also the removal of a portion of the crane runway. 150 feet has been taken down, and the traveller run has been completed for the removal of 120 feet additional.

Weather	Clear.
Wind	East to southeast.
Anemometer readings	7 a.m. 12 miles.
	1 p.m. 10 "
Thermometer readings	7 a.m. 36 degrees.
	1 p.m. 78 "

Car report and force account enclosed.

Yours truly,

B. A. YENSER.

EXHIBIT No. 82b.

(Letterhead of the Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., July 26, 1907.

THE PHŒNIX BRIDGE CO.,
Phœnixville, Penna.

GENTLEMEN,—I beg to acknowledge receipt of your two favours of the 24th inst., and have carefully noted the contents thereof.

Regarding a copy of the bridge specifications, asked for at the request of Mr. Cudworth, we have, in accordance with your instructions, told Mr. Cudworth to write you for any information on any special point he may require.

I note, particularly, what you say regarding the cost of driving rivets, and I hope to still further reduce this cost by the addition of more riveting gangs.

I fully appreciate your anxiety to learn that the traveller has been moved forward for the erection of the second panel in the suspended span, and I can assure you that everything is being done to bring this about at the earliest date, and that I will feel just as much concerned until it has been accomplished.

I further note your remarks concerning the starting of the removal of the main traveller, and would advise that all preparations for commencing this work are practically completed, and that we will go ahead with it as soon as the small traveller has been moved clear of the upper forward overhang of the main traveller.

John Simmons reached here last evening.

Yours truly,

B. A. YENSER.

EXHIBIT No. 82c.

(Letterhead of the Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., August 24, 1907.

THE PHŒNIX BRIDGE CO.,
Phœnixville, Penna.

NORTH SIDE.

GENTLEMEN,—The general condition of the work follows:—

Timber falsework.—Bent No. 1 to bent No. 7-A, inclusive, erected complete except the horizontal diagonal bracing.

Bent No. 8—The four (4) bottom sections of legs are erected and braced transversely. They are connected to bent 7-A by the longitudinal level braces.

Metal falsework.—Bent No. 2 to bent No. 6, inclusive, erected and bolted complete except a few small braces.

Bent No. 7—All the plumb posts are erected in place except one (1) in the top section of each tower. One (1) box girder is also erected in place in each tower. The two towers are connected together by the lower level strut, and to bent No. 6 by the corresponding longitudinal struts.

Metal falsework foundations.—For bent No. 10, the excavating for the west side has been started. For the east side the excavating has been discontinued for the past few days, but is down to almost the required level necessary for the regular three (3) courses of grillage timber.

For bent No. 9—The bottom course of timber is in place for the east side. For the west side fourteen (14) of the eighteen (18) pieces of the first course are in place.

For bent No. 8—The bottom course of timber is in place for both the east and west sides.

Work on foundations will again be resumed at low tide this p.m.

Jetty.—The filling in with stone continues. About 100 feet from the end of the present fill, toward the main pier, is yet to be made.

Yours truly,

B. A. YENSER.

EXHIBIT No. 82d.

(Letterhead of the Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., August 24, 1907.

THE PHŒNIX BRIDGE CO.,
Phœnixville, Pa.

SOUTH SIDE.

GENTLEMEN,—Work has gone ahead since our last report and continues at this writing, 1 p.m. The general condition is as follows:—

Erection of suspended span.—All metal has been erected in place in the third panel, and the work of bolting is being pushed to completion.

The track is being laid and the preparations going ahead for pulling the traveller forward into position for the erection of the fourth panel. This we hope to get done on Monday, the 26th inst.

Removal of main traveller.—All the lower forward overhang has been removed. These parts, together with the two (2) transverse girders—'TG—1' and 'TG—2,' have been lowered onto our large scow, and will be taken to the north side.

The work of removing all the timber from the top of the square of the traveller will be completed this p.m., after which the removal of the metal parts will be started.

Riveting.—Four (4) gangs are driving on the anchor arm and five (5) gangs on the cantilever arm.

River yard.—The usual work can be reported, viz., the removal of timber from the metal falsework foundations, the preparation of materials for delivery to the north side, and the handling and storing of main traveller parts as they are lowered from above.

Storage yard.—The separating and preparing of parts for delivery for erection, fourth panel suspended span, is going ahead.

Weather.—Cloudy; wind, east to southwest.

Anemometer readings	7 a.m.	7 Miles
	1 p.m.	20 "
Thermometer readings	7 a.m.	64 Degrees
	1 p.m.	72 "

Yours truly,

B. A. YENSER.

P.S.—Since writing the above all cars for which we hold invoices have been received and unloaded.

EXHIBIT No. 82e.

THE PHŒNIX BRIDGE COMPANY.

Quebec Bridge. *South Side.*

Report of weight on end of cantilever arm, No. 16. August 24, 1907:—

WEIGHT REMOVED.	Lbs.	Lbs.	WEIGHT ADDED.	Lbs.	Lbs.
Reports 1 to 15.. ..		462,000	Reports 1 to 15		3,068,500
Removed 8/24/07 ..			Added 8/24/07..		
Main traveller.. ..			Strut T 14..	7,000	
Timber..	42,000		Top chd. trav..		
Girders TG 1 & TG 2	30,000		Track Pan (1)	40,000	
Lower overhang.. ..	33,000				47,000
		105,000			
Removed to date ..		567,000	Added to date..		3,115,500

Remarks:

B. A. YENSER,
Foreman.

EXHIBIT No. 82f.

QUEBEC BRIDGE—DAILY FORCE ACCOUNT.

SATURDAY, August 24, 1907.

South Side:

1 general foreman.
1 foreman.
3 office.
2 civil engineer and helper.
1 electrician.
1 teamster.
2 night watch.
2 smiths' shops.
2 water boys.
1 machinist.
1 compressor.

1 asst. foreman.
2 engineers.
1 skiffman.
10 men (bolting).
13 men.
} Permanent structure.

1 asst. foreman.
1 engineer.
14 men.
} Removing main traveller.

1 riveting foreman.
2 rivet boys.
36 men (9 gangs).
} Riveting.

1 engineer.
7 men.
} Removing metal false work and main traveller.

1 man (plant).
2 men (drilling and bolting).
2 men (painting).
1 man (running down bolts).
8 men (assorting bolts).

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Storage Yard:

1 foreman. 1 crane runner. 8 men.	Unloading, distributing and preparing metal for erection.
1 semaphore attendant.	
1 engineer. 1 fireman. 1 brakeman.	Locomotive crew.
135	

North Side:

1 foreman.	
1 checker.	
1 skiffman.	
1 water boy.	
2 night watch.	
2 smith shops.	
1 asst. foreman. 2 engineers. 4 men (bolting). 9 men.	Erecting timber and metal false work.
1 asst. foreman. 8 men.	Preparations for erecting main traveller.
1 asst. foreman. 1 engineer. 11 men.	Dist'g, T. & M. false work & foundations.
1 engineer. 7 men.	Jetty.
54	

Belair Storage Yard:

1 asst. foreman.	
1 engineer.	
1 fireman.	
1 night watch.	
1 crane runner. 6 men.	Unloading and str'g metal.
11	
200 grand total.	

(Signed) B. A. YENSER,
General Foreman.

EXHIBIT No. 82g.

(Letterhead Phœnix Bridge Company.)

NEW LIVERPOOL, P.Q., CAN., Aug. 29, 1907.

THE PHŒNIX BRIDGE CO.,
Phœnixville, Penna.

North Side.

GENTLEMEN,—Operations were continued on all parts of the work yesterday p.m., but were discontinued on the erection of false work this a.m. on account of the high wind.

The general condition of the work follows:—

Timber falsework.—Bent No. 1 to No. 7-A, inclusive—Erected complete the horizontal diagonal bracing.

Bent No. 8, as reported yesterday, viz.: All legs are erected except those in the top section. They are braced transversely by the level and diagonal braces, and longitudinally by the level braces and four (4) sets of tower braces.

Metal Falsework.—Bent No. 2 to Bent No. 6, inclusive—Erected complete except seven (7) small braces. These we are unable to find at this time on account of the marks being obliterated from a number of these small members, but they are being put in place as fast as they are found.

Bent No. 7.—All the plumb and inclined posts are erected in place in both towers, also the box girders for the support of the blocking beams. The two towers are connected together, and to Bent No. 6 by the level struts.

Foundations for Metal Falsework.—No timber was placed on the last tide, the work being confined to excavating in No. 10. The general conditions are as follows: For Bent No. 8.—The east side is finished. The west side has one half of one course of timber yet to place.

For Bent No. 9.—The east side has two (2) of the four (4) courses of timber in place; the west side the bottom course.

For Bent No. 10.—We expect to finish the excavating for the east side on the next two (2) tides. The west side has about sixteen (16) inches yet to excavate.

General.—The hoisting of the ties to the deck of the Approach Span continues. All the timber blocking has been fastened in place on both the timber towers on the anchor pier.

Jetty.—Filling in with stone continues.

Yours truly,

B. A. YENSER,

EXHIBIT No. 82h.

((Letterhead of The Phœnix Bridge Co.)

NEW LIVERPOOL, *P.Q.*, CAN., Aug. 29, 1907.

THE PHŒNIX BRIDGE CO.,
Phœnixville, Pa.

South Side.

GENTLEMEN,—Work has gone ahead since our report of yesterday without interruption, and continues at this writing, 1 p.m., with the general conditions as follows:

Erection of Suspended Span.—As reported yesterday the traveller has been moved forward and anchored in position for the erection of the fourth panel.

SESSIONAL PAPER No. 154

To-day all the ties and rails have been removed from the top chord in the rear of the traveller and the supply tracks have been extended over the temporary spans 's-1-s-2' and 's-1x-s-2-x.' These spans were put in place this a.m.

The two lower chord sections R & L are loaded on cars, and we expect to put them in place this p.m.

Removal of Main Traveller.—In addition to the parts already reported as being taken down, all the sheave stands and small parts have been removed from the top of the traveller and the rigging is now going ahead for the lowering of transverse girder 'TG-4'.

Riveting.—Three gangs are driving on the anchor arm, and four (4) gangs on the cantilever arm.

This is one (1) gang less than we had riveting yesterday, it having been taken off this morning to assist on the work at the front.

River yard.—The scow has been loaded with falsework materials and taken to the north side.

The timber is yet to be removed from three (3) metal falsework foundations. This work is going ahead. Also the storing of main traveller parts as fast as they are lowered into the yard.

Storage yard.—The preparing and loading of parts for erection in the fourth panel of the suspended span continues.

Weather.—Cloudy to clear ; wind—northwest to west.

Anemometer readings—7 a.m. 29 miles.
1 p.m. 30 miles.
Thermometer readings—7 a.m. 58 degrees.
1 p.m. 65 degrees.

Your truly,

B. A. YENSER.

EXHIBIT No. 82i.

THE PHŒNIX BRIDGE COMPANY.

Quebec Bridge—South side.

Report on weight on end of cantilever arm No. 17, August 29, 1907.

WEIGHT REMOVED.

	Lbs.
Reports 1 to 16	567,000
Metal from main traveller, August 29, 1907	20,000
Removed to date	587,000

WEIGHT ADDED.

	Lbs.
Reports 1 to 16	3,115,000
Added to date	3,115,500

Remarks : Traveller now erecting panel 'D' suspended span.

B. A. YENSER, *Foreman.*

EXHIBIT No. 82j.

QUEBEC BRIDGE—DAILY FORCE ACCOUNT.

THURSDAY, August 29, 1907.

South side.

1 General foreman.
1 Foreman.
3 Office.
2 Civil engineer and helper.
1 Electrician.
1 Teamster.
2 Night watch.
2 Smith shops.
2 Water boys.
1 Machinist.
1 Compressor.

Permanent structure.

1 Assistant foreman.
2 Engineers.
1 Skiffman.
25 Men.

Removing main traveller.

1 Assistant foreman.
2 Engineers.
10 Men.

Riveting.

1 Riveting foreman.
2 Rivet boys.
28 Men (7 gangs).

Removing metal falsework.

1 Engineer.
8 Men.
4 Men (reaming and bolting)
1 Man (plant).
2 Men (painting).
1 Man (running down bolts).
10 Men (assorting bolts).

117

Storage yard—Separating, distributing and preparing metal for erection.

1 Foreman.
1 Crane runner.
7 Men.
1 Semaphore attendant.

Locomotive crew.

1 Engineer.
1 Fireman.
1 Brakeman.

130

North side.

1 Foreman.
1 Checker.
1 Skiffman.
1 Water boy.
2 Night-watch.
2 Smith shops.

Erecting metal falsework.

1 Assistant foreman.
1 Engineer.
2 Men (bolting).
15 Men.

Preparations for main traveller.

1 Assistant foreman.
1 Engineer.
6 Men.

Dist'g T. and M. falsework and foundations.

1 Assistant foreman.
1 Engineer.
11 Men.

Jetty.

1 Engineer.
8 Men.

57

Belair storage yard.

1 Assistant foreman.
1 Engineer.
1 Fireman.
1 Night-watch.

Unloading and str'g metal.

1 Crane runner.
6 Men.

11

198—Grand total.

B. A. YENSER,
General Foreman.

EXHIBIT No. 112.

(Copy.)

QUEBEC, 23rd March, 1907.

Mr. THEODORE COOPER,
Consulting Engineer,
35 Broadway, New York City.

DEAR SIR,—I am instructed by the board of directors to inform you that the verbal agreement made with you by the president in New York on the 13th instant has been unanimously ratified by the directors, that is that you undertake the examination and analysis of the several tenders and plans received on the 1st instant by this company for the construction of our proposed railway bridge, and that you will report on same to this board, your charges being a minimum fee of $2,500 for the first tender, not to exceed a maximum of $5,000 for the full work, the respective charges on the several tenders after the first one to be regulated on the actual work and, as you suggested yourself, to be arranged to the satisfaction of the president. I hope I have correctly stated the conditions.

Yours respectfully,

ULRIC BARTHE,
Secretary.

P.S.—Mr. Hoare has sent you by express a package of plans which he just told me to-day have not yet reached you. I have inquired at the express office, and the explanation is that owing to the snow blockade, the first train has left Levis last night only at nine o'clock.

U. B.

EXHIBIT No. 114.

Amounts paid to Mr. Theodore Cooper, consulting engineer, from September 18th, 1899, to February 1st, 1907:—

Sept. 18, 1899	—Cash	$3,500
June 1, 1900	"	1,050
Dec. 7, 1900	"	1,675
Aug. 23, 1901	"	4,000
Nov. 26, 1902	"	4,000
Nov. 5, 1903	"	4,000
June 16, 1904	"	4,000
July 12, 1905	"	4,000
Jan. 8, 1906	"	2,000
July 18, 1906	"	2,000
Feb. 1, 1907	"	2,000
		$32,225

J. H. PAQUET,
Treasurer.

EXHIBIT No. 122.

DR. AMI'S REPORT.

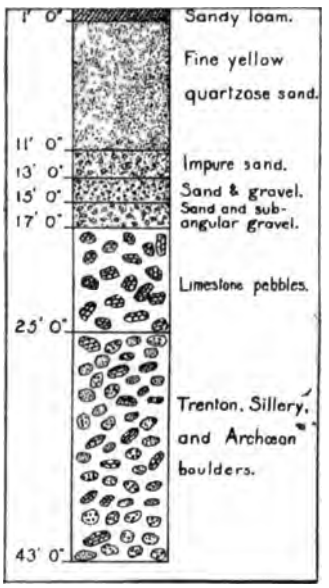
(I.) NOTES ON DRILLINGS OBTAINED IN SIX DIAMOND-DRILL BORE-HOLES IN THE BED OF THE ST. LAWRENCE RIVER AT VICTORIA COVE, SILLERY, EIGHT MILES ABOVE QUEBEC CITY, QUEBEC.

Through the kindness and courtesy of Mr. E. A. Hoare, engineer for the Quebec Bridge Company, Quebec, I had an opportunity afforded me of examining the drillings extracted from the six diamond-drill bore-holes which serve to indicate the character of the rock formations and materials occurring in the immediate vicinity of the abutments, anchor piers and main piers of the Quebec bridge now in the process of completion. The logs of the different borings were carefully preserved in boxes, and the following notes have been prepared by me, together with the sketch sections or illustrations accompanying them.

DESCRIPTIONS OF DRILLINGS.

North Side of the St. Lawrence River.

No. I. Bore-hole. 43 feet. Anchor pier, on centre line, 400 feet north of No. 3 bore-hole. Shore above water level.

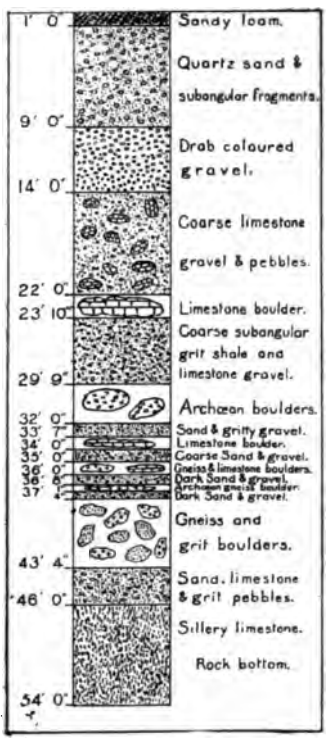


Bore-hole No. 1, North Side.

After penetrating the surface soil which consists of a sandy loam one foot in thickness in which grains of clear quartz abound, the drill traversed ten feet of fine yellow quartzose sand below which occurred two feet or more of rather impure sand, two feet more of sand and gravel underlaid by two additional feet of sand and fine subangular gravel. Eight feet were then traversed, in which limestone pebbles predominate, thus reaching a depth of twenty-five feet. Between twenty-five and forty-three feet depth, boulders of Trenton limestone associated with boulders of Archæan crystalline rocks and pebbles of sandstones belonging to the Sillery grit formation occur. This bore-hole was not continued deeper.

No. II. Bore-hole. Fifty feet east of the centre line.

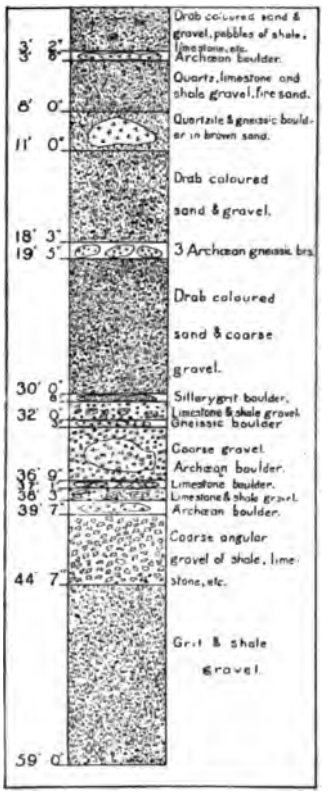
Drillings consist first of about one foot of sandy loam, followed downward by eight feet of quartzose sand rather coarser than the materials examined in bore-hole No. 1, together with a number of small subangular fragments of various kinds of rock and shale. Below this the drillings consist of five feet of a fine, well mixed, drab-coloured gravel underlaid by eight feet of coarse limestone gravel not unlike that met at the twenty-five feet depth in bore-hole No. 1. The next twenty-two inches were marked by the presence of a boulder of fossiliferous limestone underlaid by five feet and eleven inches of coarse and well mixed subangular pebbles of Sillery grit, Palæozoic limestone, shale, &c. In the next two feet three inches, a boulder of a dark crystalline Archæan basic rock occurs, probably dyke material, with garnet, &c., underlaid by one foot seven inches of coarse brownish grey quartzose sand associated with grains of felspar and grits. A limestone boulder was met in the next five inches at a depth of thirty-four feet, below which sand similar to that overlying the boulders of limestone just described above occurred to a depth of one foot, underlaid by two boulders, one, consisting of sedimentary or Palæozoic limestones, the other, an Archæan gneiss boulder. Eight inches of a dark-coloured, quartzose sand holding fragments of gneiss, the grains of both being subangular, are underlaid by a boulder of Archæan gneiss five inches in thickness, below which three inches of dark-coloured sand occurred similar to that above the last mentioned boulder. Six feet were then traversed marked by the presence of boulders, of grey greisses of Archæan age, and others of Sillery grit, underlaid by some eight inches of dark sand similar to that just described, in which were imbedded pebbles of Sillery grit, and limestone of Trenton or Black River age. The next ten feet, reaching a depth of fifty-four feet, were drilled in solid rock of typical Sillery grit, similar to that which occurs in the face of the escarpment on the north side of the river at Victoria Cove, Sillery.



Bore-hole No. 2, North Side.

No. III. Bore-hole, 480 feet from base-line, on the centre line; measurements taken from the river bed. Bed of River St. Lawrence.

Drillings at this point consist of three feet two inches of drab-coloured sand and gravel in which quartz veins predominate and fragments of felspar, limestone, arenaceous shale (resembling shales of the Lorraine formation) associated with pebbles of Archæan and Trenton (Ordovician) age, are underlaid by a boulder of Archæan rock eight inches in thickness, below which are four feet four inches of angular fragments of quartz, limestones, shales, rather free from sand and well washed and preserved. The next three feet consisted of a white quartzite and biotite (gneiss or coarsely crystalline pegmatite) boulder imbedded in a rusty, chocolate-coloured sand followed downwards by seven feet three inches of drab-coloured mixed fine and coarse gravel, below which were struck boulders of Archæan rocks consisting of light pinkish-grey micaceous and hornblendic as well as biotite gneiss reaching to a depth of nineteen feet five inches. Similar gravel to that just described above the boulders of Archæan rocks then characterize the drillings for the next ten feet seven inches down to a depth of thirty feet, where a six-inch boulder of Sillery grit was traversed by the drill. The next eighteen inches were characterized by a mixed gravel of limestone and shale fragments whose average size was about one centimetre across, below which, according to the engineer, 'a piece of a boulder was picked up with the two-and-a-half-inch pipe' measuring three inches across, which consists of a pinkish Archæan gneiss. Four feet six inches of coarse, mixed, angular gravel with boulders of Archæan rock then follow, under which occurred a boulder of fossiliferous limestone of typical Trenton age, as may be inferred from the following lists of fossil remains recognized in its mass:—



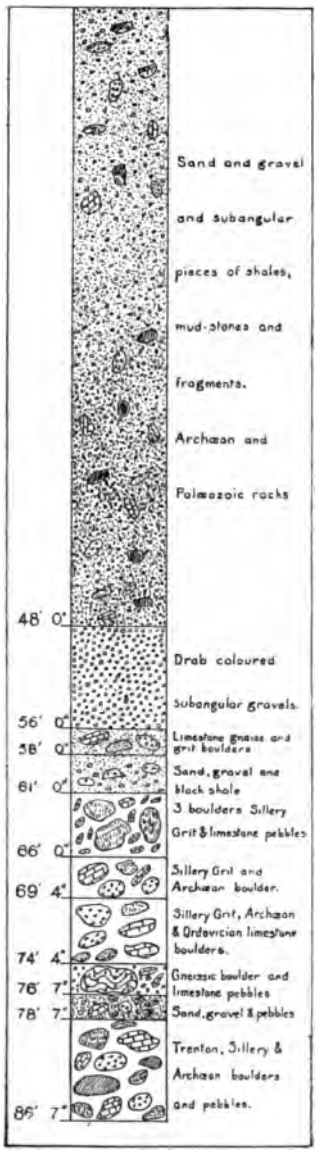
Bore-hole No. 3. North Side.

1. *Orthis* (*Dalmanella*) *testudinaria*, Dalman.
2. *Leptæna* (*Plectambonites*) *sericea*, Sowerby.
3. *Rhynchotrema inæquivalvis*, Castelnau.
4. *Pachydictya*, sp.
5. *Monticuliporoid*, indt.
6. *Trilobite* fragment, too imperfect for identification.

For one foot two inches below this Trenton boulder, similar gravel to that above the boulder occurred, followed downward by a boulder of Archæan crystalline rock to a depth of sixteen inches deeper, below which again, similar gravel was struck to a depth of forty-four feet seven inches. In the next fourteen feet five inches, the drillings gave a gravel of grit and shales. At the depth of fifty-four feet 'the tube broke' and the bore-hole was abandoned.

South Side of the St. Lawrence River.

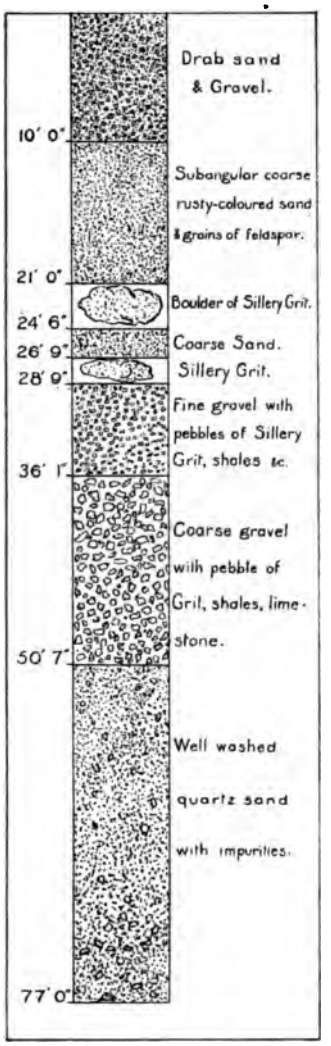
No. IV. Bore-hole. Bed of river.



Bore-hole No. 4, South Side.

The drillings which were examined as representing the first forty-eight feet of the material obtained in this bore-hole consisted of small angular pieces of Archæan and Palæozoic rocks together with water-worn and well rounded and subangular pebbles of the same rock and grey shale or siliceous mudstone. These are followed downward for eight feet by drab-coloured and subangular gravel. Then two feet of somewhat angular gravel with rounded blocks of limestone and boulders of pinkish gneiss wtih Sillery grit were traversed. The next three feet showed the presence of a sand or gravel with drab and rather dark-coloured black shale, with which were associated pebbles of Archæan gneissoid rocks and fragments of limestone, shales, &c., at times very angular. Three boulders of Sillery grit or sandstone follow with limestone pebbles in the next five feet of the drillings examined. These were underlaid by five feet four inches of similar rocks and pebbles, these in turn being underlaid by similar strata to a depth of seventy-six feet seven inches, where sand and gravel to a depth of two feet are then penetrated in which pebbles of Trenton limestone, of Archæan gneiss, of Sillery grit, black shale, &c., occur, followed downward by Trenton, Archæan and Sillery boulders to the bottom of the bore-hole at a depth of eighty-six feet seven inches, where the drilling was abandoned.

No. V. Bore-hole. Bed of river.

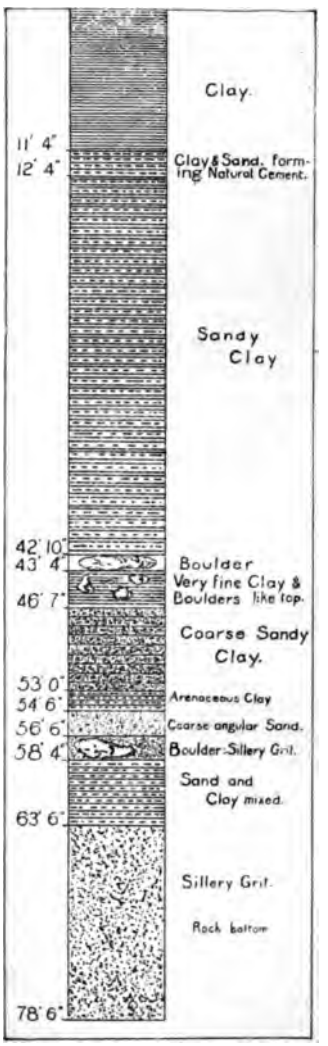


Bore-hole No. 5, South Side.

Drillings consist of drab-coloured sand and gravel associated with Sillery grit materials to a depth of ten feet, followed by eleven feet of subangular and rather coarse sand with felspar fragments, in turn underlaid by a Sillery grit boulder three feet six inches in thickness below which, two feet three inches of a coarse sand, like that above, in which boulders of gneiss, limestone and grit occur.

One of the limestone boulders contained *Leptæna* (*Plectambonites*) *sericea*, Sowerby, indicating clearly the Trenton age of the mass. A typical Sillery grit boulder two feet thick was then struck, whilst the next seven feet are characterized by a mixed coarse and fine gravel, with pebbles of clay slate, &c. This material prevails throughout the drillings downward to a depth of fifty feet seven inches, whilst the next twenty-six feet five inches are marked by the presence of well washed quartzose sand with grains of felspar, chlorite, &c., reaching to a depth of seventy-seven feet, where the drill stopped.

No. VI. bore-hole. Close to south cliff, south anchor pier, 200 feet from foot of cliff.



Bore-hole No. 6, South Side.

Eleven feet four inches of a fine grained homogeneous bluish-grey clay characterized the first series of drillings obtained. Below this bed of clay a layer one foot in thickness of a more or less arenaceous and calcareous clay occurred, which when exposed to the air forms a rather strong natural cement, the grains adhering to one another very firmly, followed by some thirty feet three inches of a more or less pure though at times arenaceous clay. At a depth of forty-three feet four inches a boulder was met with about six inches in thickness, below which occurred three feet three inches of a whitish-grey very fine clay, in which a Sillery grit boulder was struck. This clay resembles the first or surface clay described in the drillings from this bore-hole. Six feet five inches of a coarse sandy clay, mostly sand follow, below which is a similar stratum eighteen inches thick, forming a comparatively strong natural cement. Coarse angular sand follows two feet in thickness; then a Sillery grit boulder twenty-two inches in diameter, below which are five feet two inches of a coarse rusty sand, continuing to a depth of sixty-three feet six inches. The drill then traversed the solid rock to a depth of fifteen feet. No sample of the rock traversed, however, was present in the drillings, but it is very likely, and most probable, that the Sillery grit rocks were struck at the depth of sixty-three feet six inches and penetrated to the seventy-eight feet six inch level, as given in the log accompanying the drillings.

NOTE.

In connection with the building of the piers, abutments, &c., of the Quebec bridge, a number of interesting specimens were obtained and forwarded by Mr. M. P. Davis, contractor, through his manager, Mr. A. A. Stuart, to the department for examination, and as donations to the Museum. These include fossil plants obtained from excava-

tions in the caissons both on the north and south slopes of the St. Lawrence river bed, Victoria Cove, Sillery, and samples of rock materials in which these were found imbedded at various depths from the surface. Besides these, a fine block of coarsely crystalline syenite or hornblendic granite employed in the construction of the piers and abutments from the quarries at Rivière à Pierre was also presented by Mr. Davis to the National Museum, which serves to illustrate admirably the various characters of this building material so excellent for heavy masonry. Of this rock, Mr. Davis informs me that a single block was quarried which contained not less than 1,900 cubic yards, even and homogeneous in structure throughout. This single block thus weighed no less than 9,069,840 lbs., equivalent to 4,535 tons. The rock is of a light pinkish-grey colour, quite pleasing to the eye, and takes a high polish, dresses and cuts well, constituting in a marked degree a highly desirable rock for heavy works and foundations.

Geology of the Site of the Quebec Bridge.

Early in October, with a view of determining the rock materials and geological formations upon which the abutments, anchor piers and main piers of the Quebec bridge rested, the Engineer in Chief and Deputy Minister of Railways and Canals presented a request that I should make a report upon the same. The result of the examination made by me from during field-work of 1901, of the drillings obtained from the diamond drill bore-holes, along the shore and in the bed of the St. Lawrence river at Victoria Cove, Sillery, eight miles above Quebec city, were verified and a report prepared, which has been transmitted to the Department of Railways and Canals, and a duplicate copy of the same was deposited with the acting director of this department, and reads as follows:—

Preliminary Report on the Geological Formations in the vicinity of the Quebec Bridge Piers and Abutments, Victoria Cove, Sillery, Que.

From the examination made of the materials obtained from within the caisson of the south main pier of the Quebec bridge, as well as of the geological formations along the north and south shores of the St. Lawrence river at Victoria Cove, Sillery, Que., I am led to conclude that there are at least three distinct geological formations upon which the abutments, anchor piers and the north and south main piers rest, in the following ascending order of succession and of age:—

I. The Sillery grit formation.
II. The boulder clay or glacial drift formation.
III. The later Pleistocene formation.

THE ABUTMENTS.

The abutments of the Quebec bridge, both on the north and south shores of the St. Lawrence river, rest directly upon the Sillery grit formation.

This Sillery grit formation consists for the most part of greenish drab-weathering and greenish-grey sandstones or coarse grits frequently assuming the character of fine conglomerates with white quartz pebbles at time the size of peas.

These sandstones are sometimes slightly micaceous, and occasionally hold scales of green and black shale, and a few spangles of graphite. They are often calcareous. They usually present massive beds, and at Sillery, the type locality, many of the layers are quarried for building purposes, the stone being used largely in Quebec city. When broken, the rock presents a sharp, cutting edge and fracture, the grains of material composing the rock being strongly cemented together.

THE ANCHOR PIERS.

The north anchor pier rests directly upon the Sillery grit formation.

The south anchor pier rests in the upper strata of the later Pleistocene or boulder sand formation, which at this point consists for the most part of fine clay and sand filling the interstices of rounded, water-worn and subangular boulders of Archæan and Palæozoic formations, such as are seen strewn on the beach at low water, held in a matrix of stratified and well washed sand. The Archæan boulders are as varied in composition, comprising as the rocks of that primitive series the Laurentian and Huronian systems as they are developed in the province of Quebec, including many eruptives.

THE MAIN PIERS.

The materials obtained from within the caisson of the south main pier indicate the presence of both 'the boulder clay or glacial clay' formation, and the 'sand and gravel formation' or later drift.

The boulder clay or glacial drift formation occupies by far the greater portion of the area upon which the south main pier rests.

This 'boulder clay' is the characteristic 'till' or glacial clay of geologists, the 'hard-pan' of Canadian and other American engineers. It was deposited here at a remote period during the Glacial Epoch of geologists.

This formation consists of an indurated, compact, tough and unstratified rock mass, composed of rounded, angular and subangular boulders and pebbles of Laurentian and Archæan gneisses and quartzites, associated with numerous boulders and pebbles of typical Sillery grit, sandstones and shales (of which materials the Sillery formation is composed), besides well-scored and striated or glaciated pebbles of limestone derived from the Trenton and Black River limestone formations of the north shore of the St. Lawrence, all cemented by an argillaceous paste, and held compactly together.

The materials, however, that were obtained from the two most westerly compartments within the caisson, consist of the 'boulder sand and gravel formation.' Rounded and subangular boulders and pebbles of Sillery grit and sandstones, of limestone, quartzite, gneisses and various other materials (not differing materially in character and composition from the boulders and pebbles constituting the boulder clay formation), are held in a matrix of sand, which, upon examination, appears to consist of well washed and fine grains of quartz, with occasional grains of hornblende and other impurities.

The sand and gravel formation is of later date than the 'boulder clay' or glacial drift formation, and was no doubt derived from the same, and is a stratified deposit.

THE NORTH MAIN PIER.

The north main pier rests upon the sand and gravel formation. From the materials obtained from within the caisson of this pier, it is evident that the boulders of gneiss, granite, quartzites and limestone, &c., which constitute this formation, have their interstices filled with sand and gravel, and that the whole is of sedimentary origin, of later date than the 'boulder clay or glacial clay' formation, and probably derived from it for the most part, being deposited as modified and stratified drift.

H. M. AMI.

Geological Survey of Canada,
Quebec, Que., October 10, 1902.

EXHIBIT No. 125.

LIST OF PLANS OF BRIDGE, WITH IMPORTANT DATES.

Plan No.	Description.	Date of Plan.	Date Cooper Signed.	Date Signed by Dept.
70	Strain Sheet	June 2, '01		June 25, '01.
Sheet 'B'	Floor Beams for Anchor Arms	Sept. 16, '03	Sept. 24, '03	Oct. 28, '03.
" 'B'	" "	Sept. 16, '03	Sept. 24, '03	Oct. 28, '03.
" 'C'	Stringers of Anchor Arms	Sept. 16, '03	Oct. 5, '03	Oct. 28, '03.
" 'H'	Trussed Floorbeams of Cant. Arms	Dec. 2, '03	Dec. 16, '03	Jan. 19, '04.
" 'F'	Trussed " "	Nov. 20, '03	Dec. 16, '05	Jan. 19, '04.
" 'G'	" " "	Nov. 28, '03	Dec. 16, '03	Jan. 19, '04.
" 'O'	" " Anchor Arms	Dec. 24, '03	Jan. 12, '04	Jan. 27, '04.
" 'O'	" " "	Dec. 24, '03	Jan. 12, '04	Jan. 27, '04.
" 'N'	" " "	Dec. 23, '03	Feb. 26, '04	Mar. 15, '04.
" 'P'	" " "	Dec. 24, '03	Feb. 26, '04	Mar. 15, '04.
" R	Gen. Pl. 675 ft. Suspended Span	Feb. 4, '04	Mar. 29, '04	April 18, '04.
" Q	Stress Dgm. " "	Feb. 18, '04	Mar. 29, '04	April 18, '04.
3	Lower Sections of Anchorage Shell	June 1, '04	June 10, '04	July 7, '04.
1	Pins, Pilots, Washers & Bolts for Towers	May 21, '04	June 15, '04	July 7, '04.
2	I Bars for Towers (Revsd)	June 4, '04	June 7, '04	July 7, '04.
5	Top Struts for Anchor Towers	June 3, '04	June 10, '04	Aug. 2, '04.
1	Transverse Bracing for Anch. Towers	May 27, '04	June 10, '04	July 7, '04.
2	" " "	May 30, '04	June 10, '04	July 7, '04.
4	Upper Sect. Anchor Shell & Splice Pl	June 10, '04	June 15, '04	July 7, '04.
5	Top Struts for Anch. Towers	June 3, '04	June 10, '04	July 7, '04.
'U'	N. Pier Transverse View of Anch. Bent	June 24, '04	April 25, '04	Aug. 2, '04.
'U'	" " "	April 19, '04	April 25, '04	May 12, '04.
'X'	Stress D'gm. for 1500 ft. Anch. Arm	June 1, '04	June 30, '04	Oct. 11, '04.
'T'	Anchorage Shell	April 20, '04	June 10, '04	Aug. 2, '04.
'V'	Details of N. Bent	April 21, '04	April 25, '04	Aug. 2, '04.
'V'	" "	April 21, '04	April 25, '04	May 12, '04.
8	R'y Stringers for Anch. Arm	July 12, '04	July 18, '04	Aug. 9, '04.
4	" " "	July 19, '04	July 18, '04	Aug. 9, '04.
'T'	Anchorage Shell	April 20, '04	April 25, '04	May 12, '04.
9	R'y Stringers for Anch. Arms	July 12, '04	July 18, '04	Aug. 9, '04.
7	Floorbeams Anch. Arms	July 5, '04	July 18, '04	Aug. 9, '04.
1	End Bottom Chords for Anch. Arms	July 1, '04	July 9, '04	Oct. 11, '04.
5	Anch. Arm. Elec. R'y. Stringers	July 15, '04	July 22, '04	Aug. 8, '04.
6	Roadway Stringers for Anch. Arms	July 20, '04	July 27, '04	Aug. 12, '04.
10	Elec. R'y & Roadway Stringers for Anch. Arm	July 21, '04	July 27, '04	Aug. 11, '04.
11	" " " "	July 22, '04	July 27, '04	Aug. 11, '04.
'Z'	Top. Chord Pin Packing for Anch. Arm	July 12, '04	July 27, '04	Oct. 11, '04.
13	Ry. Stringers for Anch. Arm	July 26, '04	Aug. 8, '04	Sept. 7, '04.
15	" "	Aug. 1, '04	Aug. 8, '04	Sept. 7, '04.
16	" "	Aug. 3, '04	Aug. 8, '04	Sept. 7, '04.
12	Floor Beams "	July 19, '04	Aug. 1, '04	Sept. 7, '04.
14	" "	July 28, '04	Aug. 3, '04	Sept. 7, '04.
17	" "	Aug. 4, '04	Aug. 9, '04	Sept. 7, '04.
18	Elec. Ry. & Roadway Stringers for Anch. Arms	Aug. 10, '04	Aug. 15, '04	Sept. 7, '04.
19	" " "	Aug. 11, '04	Aug. 15, '04	Sept. 7, '04.
1	End Floorbeams for Anchor Arms	July 14, '04	Aug. 1, '04	Oct. 10, '04.
2	Bottom Chords for Panel 2 of Anch. Arms	July 20, '04	Aug. 19, '04	Oct. 10, '04.
22	Anch. Arm. Diags. of Transv. Brac'g at Post P1.	Aug. 26, '04	Sept. 9, '04	Oct. 17, '04.
23	" " " "	Sept. 5, '04	Sept. 9, '04	Oct. 18, '04.
11	Anchor Arm. Upper Sec's of Post P1	July 15, '04	Aug. 8, '04	Oct. 17, '04.
13	" Top Struts between Post P1	July 30, '04	Aug. 13, '04	Oct. 18, '04.
16	" Lower Trans. Struts betw Post P1.	Aug. 10, '04	Aug. 15, '04	Oct. 18, '04.
3	Bottom Chords for Panel 3 of Anch. Arms	Sept. 10, '04.	Sept. 13, '04	No date '04.
3	Lever Posts & Weights	June 15, '04	Aug. 3, '04	Oct. 17, '04.
14	Bottom Laterals for Pan. 1. Anch. Arms	Aug. 3, '04	Aug. 13, '04	Oct. 17, '04.
2	Tenon Girders, Rollers etc	June 16, '04	Sept. 7, '04	'04.
15	Hangers TO Por. Anch. Arm	Aug. 13, '04	Sept. 16, '04	Oct. 21, '04.
5	Bottom Chords for Pan'l 5 Anch. Arm	Sept. 15, '04	Sept. 23, '04	Oct. 21, '04.

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LIST OF PLANS OF BRIDGE, WITH IMPORTANT DATES—*Continued.*

Plan No.	Description.	Date of Plan.	Date Cooper Signed.	Date Signed by Dept.
18	Struts ASS1 for Anch. Arm	Aug. 18, '04	Aug. 23, '04	Oct. 21, '04.
24	Bottom Laterals for Panel 5 Anch. Arm	Aug. 25, '04	Sept. 13, '04	'04.
26	" " 6 "	Aug. 30, '04	Sept. 13, '04	Oct. 21, '04.
12	Anch. Arm. Lower Secs. of Post P1	Aug. 6, '04	Oct. 6, '04	Oct. 21, '04.
25	End Top Chord AOO for Anch. Arm	Aug. 29, '04	Sept. 8, '04	Oct. 21, 04.
27	Sub-Verticals ASVI. "	Sept. 8, '04	Sept. 16, '04	Oct. 21, '04.
4	Bottom Chords for Panel 4 "	Sept. 17, '04	Sept. 23, '04	Oct. 17, '04.
17	Bottom Laterals for Panels 2, 3 & 4	Aug. 7, '04	Aug. 23, '04	Oct. 17, '04.
30	" " 8, Anchor Arms	Sept. 10, '04		Oct. 22, '04.
6	Bottom Chords for Panel 6 "	Sept. 14, '04	Sept. 23, '04	Oct. 22, '04.
39	Top Laterals for Panel O	Sept. 19, '04	Sept. 23, '04	Oct. 22, '04.
19	Anch. Arm. Upper Secs. of Post P2	Aug. 24, '04	Sept. 21, '04	Oct. 21, '04.
21	Sub-Diagonals ASP-1 for An. Arm	Aug. 23, '04	Sept. 8, '04	Oct. 22, '04.
32	Bottom Laterals for Panel 9 An. Arm	Sept. 15, '04	Sept. 21, '04	Oct. 24, '04.
33	Anch. Arm. Top Strut betw. Sub Vert ASVI	Sept. 16, '04	Sept. 21, '04	Oct. 24, '04.
7	Bottom chords for Pan'l 7 of Anch Arms	Oct. 5, '04	Oct. 12, '04	Nov. 7, '04.
20	Anch. Arm. Lower Secs. of Post P.2	Sept. 14, '04	Sept. 21, '04	Nov. 7, '04.
34	Sub-Verticals A SV2 for Anch. Arms	Sept. 21, '04	Sept. 27, '04	Nov. 7, '04.
29	Sub-Diags A SP2 for Anch. Arm	Sept. 10, '04	Sept. 17, '04	Nov. 7, '04.
28	Bottom Laterals for Panel 7, Anch. Arms	Sept. 2, '04	Sept. 13, '04	Oct. 22, '04.
35	Hanger ATOO for Anch. Arms	Sept. 23, '04	Oct. 3, '04	Nov. 7, '04.
31	Strut ASS2 for Anchor Arm	Sept. 17, '04	Sept. 23, '04	Nov. 10, '04.
8	Bottom Chords for Pan'l 8 of Anch. Arms	Oct. 12, '04	Oct. 17, '04	Nov. 12, '04.
9	" " 9 "	Oct. 15, '04	Oct. 22, '04	Nov. 12, '04.
45	Sub-Verticals A SV-3 for Anch. Arms	Oct. 3, '04	Oct. 13, '04	Nov. 12, '04.
47	Anch. Arm. Lower Trans. Strut betw. Hangr's TO.	Oct. 4, '04	Oct. 13, '04	Dec. 14, '04.
42	Top Later'ls for Panel A	Sept. 26, '04	Oct. 5, '04	Dec. '04.
10	Bottom Chords for Pan'l 10. Anch. Arm	[Nov. 9, '04]	Oct. 24, '04	Dec. 14, '04.
40	Upper Secs. of Post P3 of "	Sept. 21, '04	Oct. 3, '04	Dec. 14, '04.
61	Anch. Arm. Top Strut at SV-2	Oct. 13, '04	Oct. 20, '04	Dec. 14, '04.
63	Anch. Arm. Diag. of Transv. bracing at hangers TO.	Oct. 20, '04	Oct. 26, '04	Dec. 14, '04.
65	Anch. Arm. Bottom Strut at SV2	Oct. 17, '04	Oct. 26, '04	Dec. 14, '04.
36	" Upper Secs. of Post P4	Sept. 27, '04	Oct. 5, '04	Dec. 14, '04.
1	Trussed Floorbeams Anc. Arm	Sept. 26, '04	Nov. 30, '04	Dec. 15, '04.
2	" "	Oct. 4, '04	Oct. 11, '04	Dec. 15, '04.
72	Anch. Arm. Diagonal of Transv. bracing of Hangers TOO	Oct. 26, '04	Nov. 30, '04	Dec. 15, '04.
69	Anch. Arm. Top Strut betw. Posts P2	Oct. 24, '04	Oct. 29, '04	Dec. 15, '04.
44	Lower Secs. of Post P3 for Anch. Arms	Oct. 19, '04	Oct. 29, '04	Dec. 15, '04.
75	Lower Pedestal for Shoe over Main Pier	Oct. 28, '04	Nov. 9, '04	Dec. 15, '04.
73	An. Arm. Diag. of Trans. bracing at hangers TOO	Nov. 3, '04	Dec. 1, '04	Dec. 16, '04.
85	Diag. of " " Post P2	Nov. 12, '04	Nov. 30, '04	Dec. 16, '04.
86	Anch. Arm Diag. of Transv. Bracing at Post P2.	Nov. 18, '04	Nov. 30, '04	Dec. 16, '04.
77	" " Lower Strut betw. Posts P2	Oct. 31, '04	Nov. 7, '04	Dec. 16, '04.
62	" " Diag. of Trans. Bracing Hang'rs TO.	Oct. 12, '04	Oct. 26, '04	Dec. 14, '04.
70	Sub Diag. (A) SP-3 for Anch. Arms	Oct. 26, '04	Nov. 1, '04	Dec. 16, '04.
3 & 4	Suspension Rods for Anch. Arms	Oct. 23, '04	Nov. 7, '04	Dec. 17, '04.
4	Trussed Floorbeams for Anch. Arms	Oct. 20, '04	Nov. 12, '04	Dec. 16, '04.
3	" " "	Nov. 1, '04	Dec. 2, '04	Dec. 16, '04.
37	A. Arm Middle Sections of Post P4	Oct. 6, '04	Oct. 12, '04	Dec. 16, '04.
68	Strut (A) SS-3 for Anch. Arm	Oct. 20, '04	Oct. 29, '04	Dec. 17, '04.
46	Top Later'ls for Panel 8	Sept. 30, '04	Oct. 13, '04	Dec. 17, '04.
84	Anch. Arm, Bottom Strut at SB-3	Nov. 11, '04	Nov. 17, '04	Jan. 3, '04.
78	" " Top Strut at SB-3	Nov. 4, '04	Nov. 9, '04	Jan. 3, '04.
6	Bracing under Trussed Floorb'ms Anch. Arms	Nov. 21, '04	Nov. 29, '04	Jan. 3, '04.
90	Anch. Arm, Lower Strut betw. Posts P3	Nov. 17, '04	Nov. 30, '04	Dec. 30, '04.
83	" " Top Strut betw. Posts P3	Nov. 11, '04	Nov. 17, '04	Dec. 30, '04.
38	" " Lower Sections of Post P4	Nov. 15, '04	Nov. 29, '04	Dec. 30, '04.
94	" " Diag. of Transv. bracing at sub-vert SV-3	Nov. 30, '04	Dec. 17, '04	Dec. 30, '04.
89	" " Diag. of Transv. bracing at sub-vert (A) SV-3	Nov. 21, '04	Dec. 5, '04	Dec. 31, '04.
99	" " Diag. of Transv. brac'g at Post P3	Nov. 28, '04	Dec. 15, '04	Dec. 31, '04.
100	" " " " "	Dec. 3, '03	Dec. 15, '04	Dec. 30, '04.
59	Top Later'ls, Panel C	Oct. 6, '04	Oct. 13, '04	Dec. 30, '04.
64	" " D	Oct. 12, '04	Oct. 20, '04	Jan. 9, '05.
79	Sub-Verticals (A) SB-5 for Anch. Arms	Nov. 4, '04	Nov. 12, '04	Jan. 16, '05.
81	Lower Sec. of Hanger TOOOO	Nov. 18, '04	Nov. 29, '04	Jan. 17, '05.

LIST OF PLANS OF BRIDGE, WITH IMPORTANT DATES—*Continued.*

Plan No.	Description.	Date of Plan.	Date Cooper Signed.	Date Signed by Dept.
80	Upper Secs. of Hanger TOOOO for Anch Arms.	Nov. 10, '04.	Nov. 16, '04.	Jan. 17, '05.
5	Trussed Floorbeams Anch. Arms	Nov. 9, '04.	Nov. 16, '04.	Jan. 17, '05.
96	Upper Secs. of Hanger T5Z for Anch. Arms	Nov. 24, '04.	Dec. 2, '04.	Jan. 31, '05.
97	Middle Secs. " " "	Dec. 3, '04.	Dec. 19, '04.	Jan. 31, '05.
98	Lower Secs. " " "	Dec. 12, '04.	Dec. 17, '04.	Jan. 31, '05.
76	Strut (A) SS4 for Anch. Arm	Nov. 7, '04.	Jan. 20, '05	Jan. 31, '05.
107	Diag'nls (A) N1 & (A) N2 for Anch. Arms	Dec. 8, '04.	Dec. 16, '04.	Jan. 31, '05.
87	Sub-Vert'cls (A) SB4 " "	Oct. 22, '04.	Oct. 29, '04.	Jan. 31, '05.
82	Sub-Diag'nls (A) SP4 " "	Nov. 16, '04.	Dec. 10, '04.	Jan. 31, '05.
87	Struts (A) SS5 & (A) SS6 " "	Nov. 14, '04.	Nov. 17, '04.	Feb. 3, '05.
95	" (A) SS7 & (A) SS8 " "	Nov. 21, '04.	Dec. 2, '04.	Feb. 3, '05.
118	" (A) SS9 & (A) SS10 " "	Dec. 21, '04.	Jan. 23, '05.	Feb. 4, '05.
123	Anch. Arm Strut (A) SS12L "	Dec. 23, '04.	Jan. 25, '05.	Feb. 4, '05.
75	Struts (A) H1 & (A) H2 " "	Dec. 3, '04.	Dec. 17, '04.	Feb. 4, '05.
113	Diag'nls (A) N3 & (A) N4 " "	Dec. 10, '04.	Jan. 23, '05.	Feb. 4, '05.
127	" (A) N5 & (A) N6 " "	Dec. 31, '04.	Jan. 23, '05.	Feb. 3, '05.
41	End of Top Chord (A) O.	Sept. 27, '04.	Jan. 26, '05.	Feb. 3, '05.
91	Anch. Arm, Upper Secs. Diag. T50.	Nov. 18, '04.	Dec. 10, '04.	Feb. 14, '05.
128	Lower Secs. of Diag. T50 for Anch. Arm	Jan. 5, '05.	Feb. 2, '05.	Feb. 14, '05.
114	Anch. Arm, Lower Secs. of Diag. T5	Dec. 13, '04.	Dec. 21, '04.	Feb. 14, '05.
125	Strut (A) H3 for Anch. Arms.	Dec. 28, '04.	Jan. 6, '05.	Feb. 14, '05.
109	Sub-Diag. (A) SP-5 for Anch. Arm.	Dec. 19, '04.	Feb. 2, '05.	Feb. 14, '05.
74	Bottom Laterals for Panel 10 Anch. Arm.	Dec. 9, '04.	Dec. 17, '04.	Feb. 14, '05.
133	Sub-Diagonals (A) SP-5 for Anch. Arm	Jan. 14, '05.	Feb. 8, '05.	Feb. 23, '05.
2	Anch. Arm I-bars for Diagonals	Oct. 20, '04.	Dec. 14, '04.	Mar. 7, '05.
1	Top Chord I-bars for panels *c, d, e, f, g* Anc. Arms.	Aug. 5, '04.	Dec. 10, '04.	Mar. 7, '05.
43	Top Later'ls for Panel O	Sept. 26, '04.	Oct. 5, '04.	Feb. 23, '05.
129	Anch. Arm, Transverse Strut (A) H4	Jan. 4, '05.	Feb. 21, '05.	Mar. 7, '05.
117	" " Strut (A) SS-11-L	Dec. 16, '04.	Dec. 21, '04.	Mar. 7, '05.
4	" " I-bars	Dec. 12, '04.	Dec. 14, '04.	Mar. 15, '05.
93	" " Strut (A) SS-14-L.	Jan. 9, '05.	Jan. 14, '05.	Mar. 15, '05.
5	" " I-bars	Jan. 3, '05.	Jan. 6, '05.	Mar. 15, '05.
92	Struts (A) SS13	Jan. 9, '05.	Jan. 14, '05.	Mar. 15, '05.
134	Anch. Arm, Later'ls (A) L-41-L	Jan. 14, '05.	Jan. 25, '05.	Mar. 15, '05.
2	Upper Pedestal for Shoe over Main Pier	Jan. 11, '05.	Jan. 23, '05.	Mar. 15, '05.
131	Anch. Arm. Upper Secs. of Diag. T5	Jan. 5, '05.	Jan. 20, '05.	Mar. 15, '05.
60	Hanger TOOO for Anch. Arm.	Oct. 8, '04.	Oct. 19 '04.	June 22, '05.
126	Top Later'ls for Pan'l H.	Jan. 12, '05.	Jan. 23, '05.	June 22, '05.
1	Cen. Post Foot over Main Pier	Jan. 16, '05.	Feb. 8, '05.	June 23, '05.
23	Brackets & Cap Pl's for Cen. Post Sec's CP1	April, 11, '05.	May 2, '05.	June 22, '05.
9	Over Main Pier, Brk'ts for transv. Bracing	Feb. 14, '05.	Feb. 20, '05.	June 22, '05.
24	Upper Top Strut betw. Cen. Posts	Mar. 28, '05	May 12, '05.	June 22, '05.
10	Secs. CP3-4 for Cen. Posts over Main Piers.	Feb. 22, '05.	Mar. 6, '05.	June 22, '05.
8	Lower Secs. of Cen. Post " "	Feb. 1, '05.	Feb. 9, '05.	June 22, '05.
5	Bottom Struts betw. Shoes " "	Jan. 26, '05.	Feb. 20, '05.	June 22, '05.
7	Bottom Diag'nls betw. Centre Posts.	Jan. 31, '05.	Feb. 16, '05.	June 22, '05.
2	Trussed Floorbeams betw. Cen. Posts	Jan. 30, '05.	Feb. 16, '05.	June 22, '05.
3	" " "	Jan. 6, '05.	Feb. 16, '05.	June 22, '05.
4	" " "	Jan. 21, '05.	Feb. 16, '05.	June 22, '05.
71	Top Later'ls for Panel 'F'	Oct. 24, '04.	Nov. 1, '04.	June 22, '05.
88	Anch. Arm Top Strut at SV4	Nov. 15, '04.	June 10, '05.	June 22, '05.
20	Stringer Seats, Anch. Arms	Aug. 11, '04.	Aug. 15, '04.	June 22, '05.
104	Anch. Arm Diag. of Transv. Br'cing at SV4.	Nov. 29, '04.	Dec. 19, '05.	June 22, '05.
105	" " " "	Dec. 12, '04.	Dec. 19, '04.	June 22, '05.
112	" " " at Post P4.	Dec. 15, '04.	Dec. 30, '05.	June 22, '05.
1	" Pins, Pilots, Washers & Bolts.	Oct. 26, '04.	Nov. 1, '04.	June 22, '05.
2	" " "	Oct. 31, '04.	Nov. 7, '04.	June 22, '05.
101	" Bottom & Intermed Struts at SV4.	Nov. 24, '04.	Dec. 2, '04.	June 22, '05.
3	" Pins, Washers & Rods.	Nov. 4, '04.	Nov. 16, '04.	June 22, '05.
13	Sect. CP2 of Cen. Post over Main Pier	Mar. 14, '05.	April 1, '05.	June 22, '05.
66	Top Later's for Pan'l E	Oct. 18, '04.	Oct. 26, '04.	June 22, '05.
122	" " G	Dec. 22, '04.	Dec. 29, '04	June 22, '05.
16	Cen. Tower, Transv. Strut	Mar. 23, '05.	May 12, '05.	June 22, '05.
22	Sec. CP1. for Cen. Post over Main Pier.	April 17, '05.	May 2, '05.	June 22, '05.
36	Upper Cen. Post Sec	May 3, '05.	(Not signed).	June 29, '05.
103	Anchor Arm Top Strut betw. Posts P4	Nov. 30, '04.	June 10, '05.	June 29, '29.
111	" Diagnl. of Transv. Br. at Post P4	Dec. 10, '04.	Dec. 20, '04.	June 29, '05
108	" Intermed. and Lower Struts betw. Posts P4	Dec. 9, '04.	Dec. 16, '04.	June 29, '05

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LIST OF PLANS OF BRIDGE, WITH IMPORTANT DATES—*Continued.*

Plan No.	Description.	Date of Plan.	Date Cooper Signed.	Date Signed by Department.
15	Transv. Bracing betw. Cen. Posts	Mar. 2, '05.	May 12, '05.	June 29, '05.
14	" " "	Feb. 24, '05.	May 12, '05.	June 29, '05.
130	End Bottom Chords over Main Shoe Anch. and Cant. Arms	Jan. 12, '05.	Feb. 2, '05.	June 29, '05.
3	Main Pier Shoes	Feb. 9, '05.	Feb. 20, '05.	June 29, '05.
11	Portal Strut betw. Cen. Posts	Feb. 25, '05.	May 10, '05.	June 29, '05.
12	Cen. Tower Bracing for Portal	Feb. 18, '05.	May 10, '05.	June 29, '05.
19	" Posts Knee Brac'g for Portal	Mar. 15, '05.	May 12, '05.	June 29, '05.
6	Anch. Arm Pins, Pilots, Washers and Bolts	June 16, '05.	Jan. 25, '05.	June 29, '05.
1a	Stress Diagm. for Cant. Arms	May 23, '05.	May 25, '05.	June 30, '05.
37	Cen. Posts, Knee Braces for Portal	April 19, '05.	May 16, '05.	June 29, '05.
25	Lower Top Strut betw. Cen. Posts	April 5, '05.	May 16, '05.	June 29, '05.
26	Bracing for Top Strut betw. Cen. Posts	April 13, '05.	May 16, '05.	June 29, '05.
30	Top Diagnls. for Portal	April 7, '05.	May 16, '05.	June 29, '05.
32	Cen. Posts Top Diagnl. for Portal	April 14, '05.	May 16, '05.	June 29, '05.
124	Anch. Arm Diagnl. of Transv. Bracing at SV5	Dec. 29, '04.	Jan. 6, '05.	July 5, '05.
120	Diagnl. of Transv. Bracing at SV5	Dec. 20, '04.	Jan. 6, '05.	July 5, '05.
110	Anch. Arm Top Strut at SV5	Dec. 14, '04.	Dec. 19, '04.	July 5, '05.
121	" Interm. and Lower Struts at SV5	Dec. 22, '04.	June 22, '05.	July 5, '05.
53	Bottom Portal Strut	Nov. 17, '04.	Jan. 13, '05.	July 24, '05.
54	Top "	Nov. 25, '04.	Jan. 13, '05.	July 24, '05.
55	Gussets for End Posts	Nov. 14, '04.	Jan. 13, '05.	July 24, '05.
132	" End Top Chord A O for Anc. Arm.	Jan. 4, '05.	Jan. 13, '05.	July 24, '05.
51	Diagnls. for End Portal Struts	Oct. 29, '04.	Jan. 13, '05.	July 24, '05.
52	" "	Nov. 8, '04.	Jan. 13, '05.	July 24, '05.
9	Bottom Chords Panel 9 for Cant. Arms	July 8, '05.	July 14, '05.	Aug. 22, '05.
50	End Post	Nov. 3, '04.	Jan. 13, '05.	Aug. 22, '05.
115	"	Dec. 14, '04.	Jan. 13, '05.	Aug. 22, '05.
15	Upper Sections of T5Z for Cant. Arms	Aug. 3, '05.	Aug. 11, '05.	Dec. 9, '05.
16	Panel 9 Bottom Laterals for "	July 26, '05.	Aug. 7, '05.	Dec. 9, '05.
21	Brackets at End Floorbeam Anch. Arms	Jan. 19, '05.	May 10, '05.	Dec. 9, '05.
11	Panel 10 Bottom Laterals Cant. Arms	July 17, '05.	Aug. 7, '05.	Dec. 9, '05.
10	Bottom Chords Panel 10 Cant. Arms	July 29, '05.	Aug. 4, '05.	Dec. 9, '05.
3	Members of Trussed Floorbeam 10 Cant. Arms.	Aug. 9, '05.	Aug. 24, '05.	Dec. 9, '05.
45	Middle Sec. of Post P4 for Cant. Arms	Sept. 16, '05.	Nov. 4, '05.	Dec. 9, '05.
46	Lower Secs. of Post P4 "	Sept. 6, '05.	Nov. 4, '05.	Dec. 9, '05.
2	Members of Trussed Floorbeam FB10 Cant. Arm.	July 21, '05.	Aug. 23, '05.	Dec. 9, '05.
1	Top Chords " FB9 and FB10 Cant. Arms	July 17, '05.	Aug. 23, '05.	Dec. 9, '05.
18	Lower Secs. of Diagnl. T5 for Cant. Arm.	July 28, '05.	Aug. 23, '05.	Dec. 28, '05.
22	Upper Secs. " "	Aug. 7, '05.	Aug. 23, '05.	Dec. 28, '05.
1	Ry. Stringers for Cant. Arms	Aug. 31, '05.	Sept. 22, '05.	Dec. 9, '05.
1	" Suspended Span	Aug. 26, '05.	Sept. 22, '05.	Dec. 9, '05.
4	Diagnl. Bracing Upper Truss'd Floorbeam FB10 Cant. Arms	Aug. 16, '05.	Aug. 30, '05.	Dec. 9, '05.
24	Side Struts SS4 and SS5 Cant. Arms	Aug. 11, '05.	Aug. 28, '05.	Dec. 27, '05.
33	Upper Secs. of Diagnl. T50 Cant. Arms	Aug. 16, '05.	Aug. 30, '05.	Dec. 27, '05.
28	Sub-Diagnls. SP5 for Cant. Arms	Aug. 18, '05.	Aug. 29, '05.	Dec. 26, '05.
29	" " "	Aug. 11, '05.	Aug. 28, '05.	Dec. 26, '05.
12	Strut SS1 for Cant. Arms.	July 24, '05.	Aug. 7, '05.	Jan. 5, '06.
19	" SS2 and SS3 for Cant. Arms.	Aug. 2, '05.	Aug. 11, '05.	Jan. 4, 06.
26	" SS6 for Cant. Arms	Aug. 9, '05.	Aug. 23, '05.	Jan. 4, '06.
25	" SS7L "	Aug. 9, '05.	Aug. 29, '05.	Jan. 4, '06.
31	" H2 "	Aug. 14, '05.	Sept. 7, '05.	Jan. 6, '06.
32	" H3 "	Aug. 14, '05.	Aug. 30, '05.	Jan. 4, '06.
27	Sub-Diagnl. SP5 "	Aug. 10, '05.	Aug. 24, '05.	Jan. 4, '06.
17	Bottom & Intermed. Struts at SV5 for Cant. Arms	July 27, '05.	Aug. 28, '05.	Jan. 10, '06.
30	Top Strut at SV5 for Cant. Arms	Aug. 10, '05.	Aug. 29, '05.	Jan. 10, '06.
20	Strut H1 for Cant. Arms	July 31, '05.	Aug. 24, '05.	Jan. 10, '06.
23	Diagnls. N1 and N2 for Cant. Arms	Aug. 9, '05.	Aug. 23, '05.	Jan. 10, '06.
21	Diagnl. Bracing at SV5 for Cant. Arm.s	Aug. 3, '05.	Aug. 29, '05.	Jan. 10, '06.
35	Lateral L11L for Cant. Arms	Aug. 17, '05.	Aug. 30, '05.	Jan. 10, '06.
34	Sub-Vert. SV5 "	Aug. 16, '05.	Sept. 7, '05.	Jan. 30, '06.
5	Strut T6 Under Floorbeam FB10 for Cant. Arms.	Aug. 19, '05.	Aug. 30, '05.	Jan. 30, '06.
36	Diagnls. N3 and N4 for Cant. Arms	Aug. 17, '05.	Sept. 7, '05.	Jan. 31, '06.
37	Top Laterals for Panel H "	Aug. 22, '05.	Sept. 7, '05.	Jan. 31, '06.
38	Lower Secs. of Diagnl. T50 "	Aug. 24, '05.	Sept. 9, '05.	Jan. 31, '06.
1	Pins for Cant. Arms	July 25, '05.	Sept. 9, '05.	Jan. 31, '06.
49	Strut SS8 "	Aug. 5, '05.	Sept. 9, '05.	Jan. 31, '06.

LIST OF PLANS OF BRIDGE, WITH IMPORTANT DATES—*Continued.*

Plan No.	Description.	Date of Plan.	Date Cooper Signed.	Date Signed by Department.
7	Strut T2A Under Trussed Floorbeam FB9 Cant. Arms	Aug. 31, '05.	Sept. 9, '05.	Jan. 31, '06.
4	Roadway Stringers for Cant. Arms	Sept. 25, '05.	Nov. 8, '05.	Feb. 1, '06.
6	Members of Trus'd Fl'b'm FB9 for Cant. Arms.	Aug. 30, '05.	Sept. 9, '05.	Feb. 1, '06.
3	Pilots, Rods, Caps, &c., for Cant. Arms	Aug. 3, '05.	Nov. 8, '05.	Feb. 6, '06.
7	Stringer Seats for Cant. Arms	Oct. 5, '05.	Nov. 8, '05.	Feb. 1, '06.
8	Members of Trus'd Flr'bm FB9 for Cant. Arms.	Sept. 5, '05.	Sept. 9, '05.	Feb. 1, '06.
8	Bottom Chords Panel 8 Cant. Arms	Oct. 11, '05.	Nov. 15, '05.	Feb. 2, '06.
3	Elec. Ry. Stringers for "	Sept. 23, '05.	Nov. 8, '05.	Feb. 2, '06.
51	Sub-Vertical SV4 for "	Sept. , '05.	Nov. 18, '05.	Feb. 2, '06.
2	Railway Stringers for "	Sept. 16, '05.	Nov. 17, '05.	Feb. 3, '06.
52	Top Strut at SV4 for "	Sept. 25, '05.	Nov. 20, '05.	Feb. 3, '06.
53	Bottom and Intermed. Struts SV4 Cant. Arms.	Sept. 28, '05.	Nov. 21, '05.	Feb. 3, '06.
5	Elec. Ry. Stringers for Cant. Arms	Sept. 29, '05.	Nov. 22, '05.	Feb. 13, '06.
6	Roadway " "	Oct. 2, '05.	Nov. 22, '05.	Feb. 13, '06.
57	Diagnl. Bracing at SV4 "	Oct. 5, '05.	Nov. 21, '05.	Feb. 13, '06.
10	Strut T2V Under Trussed Floorbeam FB8 for Cant. Arms	Oct. 6, '05.	Nov. 23, '05.	Feb. 15, '06.
9	Top Chord Trussed Flr'b'm FB8 for Cant. Arms.	Oct. 3, '05.	Nov. 22, '05.	Feb. 15, '06.
59	Sub-Diagonal USP4 for Cant. Arms	Oct. 13, '05.	Nov. 23, '05.	Feb. 15, '06.
11	Members of Trussed Flr'b'm FB8 for Cant. Arms.	Oct. 11, '05.	Nov. 23, '05.	Feb. 17, '06.
48	Strut H4 for Cant. Arms	Oct. 20, '05.	Nov. 25, '05.	Feb. 17, '06.
54	Sub-Diagnl. SP4 for Cant. Arms	Sept. 28, '05.	Nov 24, '05.	Feb. 16, '06.
8	Railway Stringers "	Oct. 9, '05.	Nov. 24, '05.	Feb. 16, '06.
9	Elec. Ry. " "	Oct. 21, '05.	Nov. 24, '05.	Feb. 21, '06.
61	Struts SS9 and SS10 "	Oct. 18, '05.	Nov. 25, '05.	Feb. 21, '06.
62	Diagnls. N5 and N6 "	Oct. 21, '05.	Nov. 25, '05.	Feb. 20, '06.
14	Floorbeam FB6 "	Nov. 3, '05.	Nov. 28, '05.	Feb. 23, '06.
55	Lower Secs. of Hanger T4Z for Cant. Arms.	Oct. 3, '05.	Nov. 29, '05.	Feb. 24, '06.
7	Pin Packing for Diagnl. Bars T4 "	Dec. 7, '05.	Dec. 13, '05.	Feb. 23, '06.
66	Bottom Laterals Panel 6 for Cant. Arms	Nov. 9, '05.	Nov. 29, '05.	Feb. 24, '06.
3	I Bars for Cant. Arms.	Nov. 9, '05.	Dec. 13, '05.	Feb. 26, '06.
6	Bottom Chords Pan'l 6 for Cant. Arms.	Oct. 23, '05.	Nov. 28, '05.	Feb. 26, '06.
1	I Bars for Cant. Arms.	July 28, '05.	Aug. 4, '05.	Mar. 5, '06.
15	Elec. R'y Stringers for Cant Arms.	Nov. 13, '05.	Dec. 16, '05.	Mar. 9, '06.
4	I Bars for Cant. Arms.	Nov. 10, '05.	Dec. 13, '05.	Mar. 9, '06.
69	Top Later'ls for Panel G. Cant. Arms.	Nov. 14, '05.	Dec. 7, '05.	Mar. 10, '06.
56	Upper Sec'ts of Hanger T4Z "	Oct. 26, '05.	Dec. 4, '05.	Mar. 5, '06.
73	Top Later'ls for Panel F "	Nov. 21, '05.	Dec. 15, '05.	Mar. 8, '06.
47	Upper Sec's of Post P4 "	Nov. 27, '05.	Dec. 21, '05.	Mar. 20, '03.
16	R'dwy Stringers "	Nov. 21, '05.	Dec. 15, '05.	Mar. 20, '06.
10	" " "	Oct. 27, '05.	Dec. 15, '05.	Mar. 27, '06.
64	Struts SS11 "	Oct. 27, '05.	Dec. 5, '05.	Mar. 26, '06.
63	Panel 7 Bottom Later'ls "	Oct. 26, '05.	Dec. 5, '05.	Mar. 24, '06.
18	Floorbeam FB5 & FB3 "	Nov. 24, '05.	Dec. 29, '05.	Mar. 26, '06.
11	Floorbeam FB7 "	Oct. 20, '05.	Nov. 28, '05.	Mar. 26, '06.
71	4 Diagn'ls of Transv. brac. at Post P4 Cant. Arms	Nov. 15, '05.	Dec. 5, '05.	Mar. 26, '06.
67	2 " " "	Nov. 8, '05.	Dec. 5, '05.	Mar. 29, '06.
13	R'y Stringers for Cant. Arms.	Nov. 8, '05.	Dec. 16, '05.	Mar. 27, '06.
2&4	Suspension R'ds for "	Nov. 2, '05.	Dec. 14, '05.	Mar. 28, '06.
65	Intermed. & lower Struts betw. Posts P4, C. Arms.	Oct. 30, '05.	Nov. 28, '05.	April 5, '06.
70	Bottom Later'ls Pan'l 5 for Cant. Arms	Nov. 16, '05.	Dec. 7, '05.	April 5, '06.
12	R'dway Stringers "	Oct. 30, '05.	Dec. 15, '05.	April 5, '06.
75	Sub-Vert SV3 "	Nov. 27, '05.	Dec. 28, '05.	April 18, '06.
79	Lower Strut betw. Posts P3 "	Dec. 6, '05.	Jan. 3, '06.	April 18, '06.
3	Bottom Chords Pan'l No. 3 "	Jan. 29, '05.	Feb. 28, '06.	April 19, '06.
17	Floorbeams FB4 & FB2 "	Dec. 9, '05.	Jan. 31, '06.	April 18, '06.
68	Top Strut at P4 "	Nov. 21, '05.	Dec. 15, '05.	April 18, '06.
135	Cornice for bottom Portal Strut		Mar. 28, '06.	April 18, '06.
83	Top Later'ls for Panel E for Can. Arms	Dec. 12, '05.	Jan. 5, '06.	April 19, '06.
74	Strut SS12 "	Nov. 27, '05.	Dec. 22, '05.	April 19, '06.
141	Portal	Jan. 23, '05.	Mar. 28, '06.	April 19, '06.
7	Bottom Chords Pan'l 7 for Cant. Arms	Oct. 3, '05.	Nov. 17, '05.	April 11, '06.
89	Top Later'ls for Pan'l D "	Dec. 20, '05.	Jan. 23, '06.	April 11, '06.
88	Sub Diag'nl SP2 "	Dec. 18, '05.	Jan. 22, '06.	April 12, '06.
2	Pins for Cant. Arms	July 28, '05.	Dec. 29, '05.	April 10, '06.
5&6	Suspension R'ds for Cant. Arms	Nov. 20, '05.	Dec. 14, '05.	April 10, '06.
90	Hanger TOOL "	Dec. 26, '05.	Jan. 26, '06.	April 10, '06.
93	Top Latr'ls Pan'l C "	Jan. 2, '06.	Jan. 31, '06.	April 10, '06.
60	Pan'l 8 Bottom Latr'ls "	Oct. 17, '05.	Dec. 5, '05.	April 10, '06.
78	*Hanger TOOL* "	Dec. 1, '05.	Jan. 3, '06.	April 11, '06.

SESSIONAL PAPER No. 154

LIST OF PLANS OF BRIDGE, WITH IMPORTANT DATES—*Continued.*

Plan No.	Description.	Date of Plan.	Date Cooper Signed.	Date Signed by Department.
116	Cornice for End Post	Dec. 24, '04.	Mar. 28, '06.	April 10, '06.
119	Ornaments for Portal Strut Anchor Arms	Dec. 19, '04.	Mar. 28, '06.	April 10, '06.
137	Detail Cornice Mo'ld'g for Bottom Portal Strut	Feb. 4, '05.	Mar. 28, '06.	April 12, '06.
49	Cornice for End Post EP	Oct. 11, '04.	Mar. 28, '06.	April 12, '06.
56	" " "		Mar. 28, '06.	April 10, '06.
48	Caps for End Posts EP, R & L		Mar. 28, '06.	April 1, '06.
57	Cornice for Posts " "	Nov. 22, '04.	Mar. 28, '06.	April 1, '06.
102	" " " "	Dec. 3, '04.	Mar. 28, '06.	April 7, '06.
106	Caps for End Posts EP	Dec. 12, '04.	Mar. 28, '06.	April 7, '06.
58	" " "	Nov. 24, '04.	Mar. 28, '06.	April 18, '06.
84	Diag'l of Transv. bracing betw. Posts P3, Cant. Arms	Dec. 18, '05.	Jan. 31, '06.	April 18, '06.
43	Lower Sec's of Post P3 for Cant. Arms	Dec. 4, '05.	Jan. 7, '06.	April 17, '06.
80	Bottom Strut SV3 "	Dec. 5, '05.	Jan. 3, '06.	April 17, '06.
85	Diagn'l of Transv. Brac. betw. Posts P3 Cant. Arms	Jan. 3, '06.	Jan. 31, '06.	April 20, '06.
86	Strut SS13 for Cant. Arms	Dec. 16, '05.	Jan. 22, '06.	April 20, '06.
4	Bottom Chords Pan'l 4 for Cant. Arms	Jan. 2, '06.	Feb. 6, '06.	April 20, '06.
5	" " 5 "	Dec. 4, '05.	Jan. 5, '06.	April 20, '06.
81	Diag'nl Brace at Sub-Vert SV3 "	Dec. 14, '05.	Jan. 22, '06.	April 19, '06.
6	Pins, Caps, Washers etc. "	Nov. 30, '05.	Dec. 29, '05.	April 19, '06.
7	" Rods, Caps, Pilots etc. "	Dec. 18, '05.	Jan. 26, '06.	April 19, '06.
8	Pin Pack'g for diagn'l Bars T3 "	Dec. 13, '05.	Jan. 17, '06.	April 20, '06.
82	Diag'nl Bracing at Sub-Vert SV3 "	Dec. 21, '05.	Jan. 22, '06.	April 20, '06.
87	Sub-Vert'l SV2 "	Dec. 16, '05.	Jan. 19, '06.	April 19, '06.
136	Full Size detail Mold'g for Cornice, Bot. Portal Strut	Jan. 28, '05.	Mar. 28, '06.	April 19, '06.
28	Top Later'l Pls. at Cen. Post	Mar. 29, '05.	May 16, '05.	May 7, '06.
38	Cen. Tower Roof Sections	April 24, '05.	April 1, '06.	May 7, '06.
34	" "	April 19, '05.	April '06.	May 7, '06.
33	" "	April 14, '05.	April 1, '06.	May 8, '06.
18	" "	Mar. 9, '05.	April 1, '06.	May 7, '06.
17	" "	Mar. 7, '05.	April 1, '06.	May 7, '06.
27	Peak of Cen. Post	Mar. 28, '05.	April 11 '06.	May 7, '06.
29	" "	April 10, '05.	April 11, '06.	May 4, '06.
31	" "	April 11, '05.	April 1, '06.	May 7 '06.
44	Upper Secs of Post P3 for Cant. Arm.	Jan. 10, '06.	Feb. 14, '06.	May 14, '06.
41	Lower " " P2 "	Jan. 4, '06.	Feb. 9, '06.	May 12, '06.
35	Cen. Tower	April 1, '05.	April 1, '06.	May 2, '06.
3	Erect'n Plan for Tower	May 13, '05.	April 11, '06.	May '06.
6	Shims for Anch. "	May 3, '05.	April 1, '06.	May 14, '06.
20	Cen. Tower Roof Sects.		April 1, '06.	May 14, '06.
21	" "	April 3, '05.	April 1, '06.	May 11, '06.
7	Anch. Arm, Pins, Washers & Nuts	April 17, '05.	May 10, '05.	May 18, '06.
92	Bottom Later'ls Pan'l 4 for Cant. Arms	Jan. 6, '06.	Feb. 16, '06.	June 29, '06.
98	" " " 3 "	Jan. 16, '06.	Feb. 16, '06.	June 28, '06.
102	Top " " 13 "	Jan. 10, '06.	Feb. 9, '06.	June 27, '06.
91	" Strut at SV2 "	Dec. 26, '05.	Jan. 26, '06.	June 29, '06.
94	" " P2 "	Mar. 12, '06.	Mar. 27, '06.	June 29, '06.
76	" " P3 "	Dec. 8, '05.	Mar. 27, '06.	June 29, '06.
95	Bottom " SV2 "	Jan. 2, '06.	Feb. 16, '06.	June 29, '06.
99	" Strut betw. P2 "	Jan. 9, '06.	Feb. 16, '06.	June 28, '06.
2	" Chords Pan'l 2 "	Feb. 20, '06.	Mar. 14, '06.	June 29, '06.
39	Lower Sec's of Post P1 "	Feb. 6, '06.	Mar. 14, '06.	July 26, '06.
100	Diag'nl Bracing at SV2 "	Jan. 9, '06.	Feb. 16, '06.	June 28, '06.
101	" " " "	Jan. 15, '06.	Feb. 16, '06.	July 26, '06.
95	" Transv. Bracing betw. Posts P2 Cant. Arms	Jan. 26, '06.	Feb. 16, '06.	June 27, '06.
77	Top Strut at SV3 for Cant. Arms	Dec. 6, '05.	Jan. 3, '06.	July 3, '06.
104	Bottom Strut P1 "	Jan. 24, '06.	Mar. 27, '06.	July 3, '06.
105	" Latrls Pn'l 2 "	Feb. 7, '06.	Mar. 13, '06.	July 3, '06.
19	R'y Stringers "	'05.	Jan. 31, '06.	June 29, '06.
21	Roadw'y Stringers "	Dec. 23, '05.	Feb. 1, '06.	July 3, '06.
20	Elec. R'y " "	Dec. 26, '05.	Feb. 1, '06.	June 29, '06.
5	I-bars for Cant. Arms	Nov. 13, '05.	Jan. 18, '06.	July 3, '06.
8	Pins, Rods, Caps, Pilots, &c. for Cant. Arms	Feb. 6, '06.	Mar. 13, '06.	July 3, '06.
42	Upper Sec. of Post P2 "	Feb. 6, '06.	Mar. 10, '06.	July 26, '06.
9	Pins, Rods, Caps, etc., for Cant. Arms.	July 14, '06.	Sept. 12, '06.	May 16, '07.
10	I-bars " " "	July 11, '06.	Sept. 6, '06.	May 14, '07.
11	Pin Po'kg for diagonal Bars T2 Cant. Arms	July 28, '06.	Sept. 6, '06.	May 14, '07.

LIST OF PLANS OF BRIDGE, WITH IMPORTANT DATES—*Continued.*

Plan No.	Description.	Date of Plan.	Date Cooper Signed.	Date Signed by Department.
13	I-bars for Panl. OO for Cant. Arms.	Aug. 13, '06.	Sept. 12, '06.	May 15, '07.
40	Upper Sec. of Post P1 " "	July 23, '06.	Sept. 6, '06.	May 14, '07.
109	Hanger TOL " "	July 25, '06.	Aug. 24, '06.	May 14, '07.
111	Sub diagonal SP1 " "	June 5, '06.	Aug. 24, '06.	May 14, '07.
113	Bottom Strut at SP1 " "	July 13, '06.	Aug. 24, '06.	May 14, '07.
114	Top Strut at SV1 " "	Aug. 17, '06.	Sept. 12, '06.	May 16, '07.
115	Transv. Bracing betw. SV1 " "	Aug. 8, '06.	Sept. 13, '06.	May 17, '07.
116	Top Laterals for Pan'l OO " "	Aug. 9, '06.	Sept. 6, '06.	May 17, '07.
117	Strut OO Top Chord OO " "	Aug. 10, '06.	Sept. 12, '06.	May 15, '07.
118	Sub-Ver't'l SV1 " "	Aug. 20, '06.	Sept. 13, '06.	May 15, '07.
119	Transv. Bracing betw. SV1 " "	Aug. 22, '06.	Sept. 13, '06.	May 15, '07.
107	Diag'nl of transv. br'cing betw. Post P1 Cant. Ar.	May 21, '06.	Aug. 24, '06.	May 22, '07.
108	" " " " "	May 21, '06.	Aug. 24, '06.	May 21, '07.
10	Pins, Caps, Pilots, etc., for Cant. Arm	Oct. 19, '06.	Nov. 23, '06.	May 21, '07.
15	I-bars for Pan'l O " " "	Sept. 28, '06.	Oct. 24, '06.	May 21, '07.
14	Eye-bars for Cant. Arms	Aug. 29, '06.	Oct. 18, '06.	May 20, '07.
130	Top Chord Strut Pan'l O for Cant. Arm.	Nov. 13, '06.	D-c. 17, '06.	May 20, '07.
125	Top Lat'rl Pl's Pan'l O " " "	Oct. 26, '06.	Nov. 23, '06.	May 21, '07.
126	" " Pan'l O " " "	Oct. 29, '06.	Nov. 23, '06.	May 21, '07.
112	" " " A " " "	July 25, '06.	Aug. 9, '06.	May 20, '07.
121	Bottom Lat'rl Panel 1 " " "	Sept. 26, '06.	Oct. 11, '06.	May 17, '07.
1	Bottom Chords " " " "	.....	Oct. 13, '06.	May 17, '07.
123	Bottom Lateral Struts " " "	Oct. 15, '06.	Oct. 18, '06.	May 18, '07.
110	Top Strut at Post PI " " "	May 25, '06.	Aug. 9, '06.	May 20, '07.
106	Strut SS 14 " " "	Mar. 30, '06.	Aug. 9, '06.	May 20, '07.
27	Stringer Br'kts " " "	Nov. 2, '06.	Nov. 28, '06.	May 20, '07.
25	Roadway Stringers " " "	Sept.	Sept. 29, '06.	May 20, '07.
24	R'y Stringers " " "	Sept. 13, '06.	Sept. 29, '06.	May 22, '07.
23	Elec. R'y Stringers " " "	Sept. 7, '06.	Sept. 29, '06.	May 20, '07.
12	Pin Pc'kg for diagonal Bars T1 for Cant. Arms.	July 30, '06.	Oct. 18, '06.	May 18, '07.
1	" " Suspended Span.	Feb. 8, '07.	Mar. 7, '07.	May 22, '07.
2	Eye Bars " " "	Feb. 13, '07.	Mar. 7, '07.	May 22, '07.
14	Stringer Bk'ts " "	Jan. 25, '07.	Feb. 19, '07.	May 20, '07.
10	End Floor bm. & Horiz. Girder for Susp. Span.	Jan. 17, '07.	Feb. 14, '07.	May 22, '07.
26	" " " " Cant. Arms.	Oct. 19, '06.	Oct. 25, '06.	May 21, '07.
1	Rectang. Pins betw. Susp. Span & Cant.	Feb. 14, '07.	Mar. 21, '07.	May 22, '07.
3	Top Strut at E. P. for Susp. Span	Oct. 12, '06.	Oct. 20, '06.	May 17, '07.
2	Bottom Strut at E. P. for Susp. Span	Oct. 1, '06.	Oct. 18, '06.	May 18, '07.
1	End Post E. P. " " "	Oct. 13, '06.	Oct. 17, '06.	May 18, '07.
4	Dia'gn'l of Transv. Bracing at Post E. P. at Susp. Span	Oct. 9, '06.	Oct. 18, '06.	May 17, '07.
5	Dia'gn'l of Transv. Bracing at Post E.P. at Susp. Span	Oct. 12, '06.	Oct. 18, '06.	May 18, '07.
6	Connecting Links for Susp Span	Nov. 3, '06	Nov. 16, '06.	May 18, '07.
Q.	(Revr'sd.) Stress Dg'm for 1 675 ft. Susp. Span.	Nov. 27, '06.	May 17, '07.	June 3, '07.
10	End Bottom Chord Sec'ts for " "	Jan. 11, '07.	Feb. 6, '07.	May 31, '07.
72	Sub-Diag'nl SP3 for Cant. Arms.	Nov. 27, '05.	Mar. 7, '06.	May 31, '07.
14	Middle Sec'ts of Hanger T5Z Arms.	.....	Aug. 9, '05.	May 31, '07.
13	Lower Sec'ts " " "	July 18, '05.	Aug. 9, '05.	May 31, '07.
47	Transv. Bracing betw. SV2 for Susp. Span.	Feb. 14, '07.	Feb. 21, '07.	June 12, '07.
45	" " " " "	Feb. 8, '07.	Mar. 1, '07.	June 20, '07.
31	" " " " "	Jan. 29, '07.	Feb. 21, '07.	June 24, '08.
57	" " Posts P2 " "	Feb. 19, '07.	Mar. 21, '07.	June 24, '07.
58	" " " " "	Feb. 25, '07.	Mar. 21, '07.	June 18, '07.
62	" " SV3 & P3 " "	Mar. 8, '07.	Mar. 28, '07.	June 17, '07.
61	" " " " "	Mar. 4, '07.	Mar. 28, '07.	June 18, '07.
38	" " SV1 " "	Feb. 4, '07.	Feb. 21, '07.	June 12, '07.
39	" " Posts P1 " "	Feb. 2, '07.	Feb. 26, '07.	June 12, '07.
40	" " " " "	Feb. 8, '07.	Feb. 26, '07.	June 12, '07.
48	Top Later'ls Panels E & F " "	Feb. 13, '07.	Mar. 28, '07.	June 12, '07.
7	" " A " "	Dec. 10, '06.	Jan. 15, '07.	June 13, '07.
25	" " B " "	Jan. 24, '07.	Feb. 1, '07.	June 1, '07.
34	" " B " "	Jan. 29, '07.	Feb. 15, '07.	June 17, '07.
23	" " C " "	Jan. 24, '07.	Feb. 6, '07.	June 17, '07.
56	Bottom Lat'rls " 1 " "	Feb. 19, '07.	Mar. 6, '07.	June 17, '07.
65	" " 2 " "	Feb. 28, '07.	Mar. 13, '07.	June 12, '07.
66	" " 3 & 4 " "	Feb. 28, '07.	Apr. 12 '07.	June 14, '07.
33	" " O " "	Jan. 31, '07.	Feb. 19, '07.	June 14, '07.
55	" " OO " "	Feb. 19, '07.	Mar. 6, '07.	June 15, '07.
43	" Struts " "	Feb. 6, '07.	Mar. 1, '07.	June 11, '07.

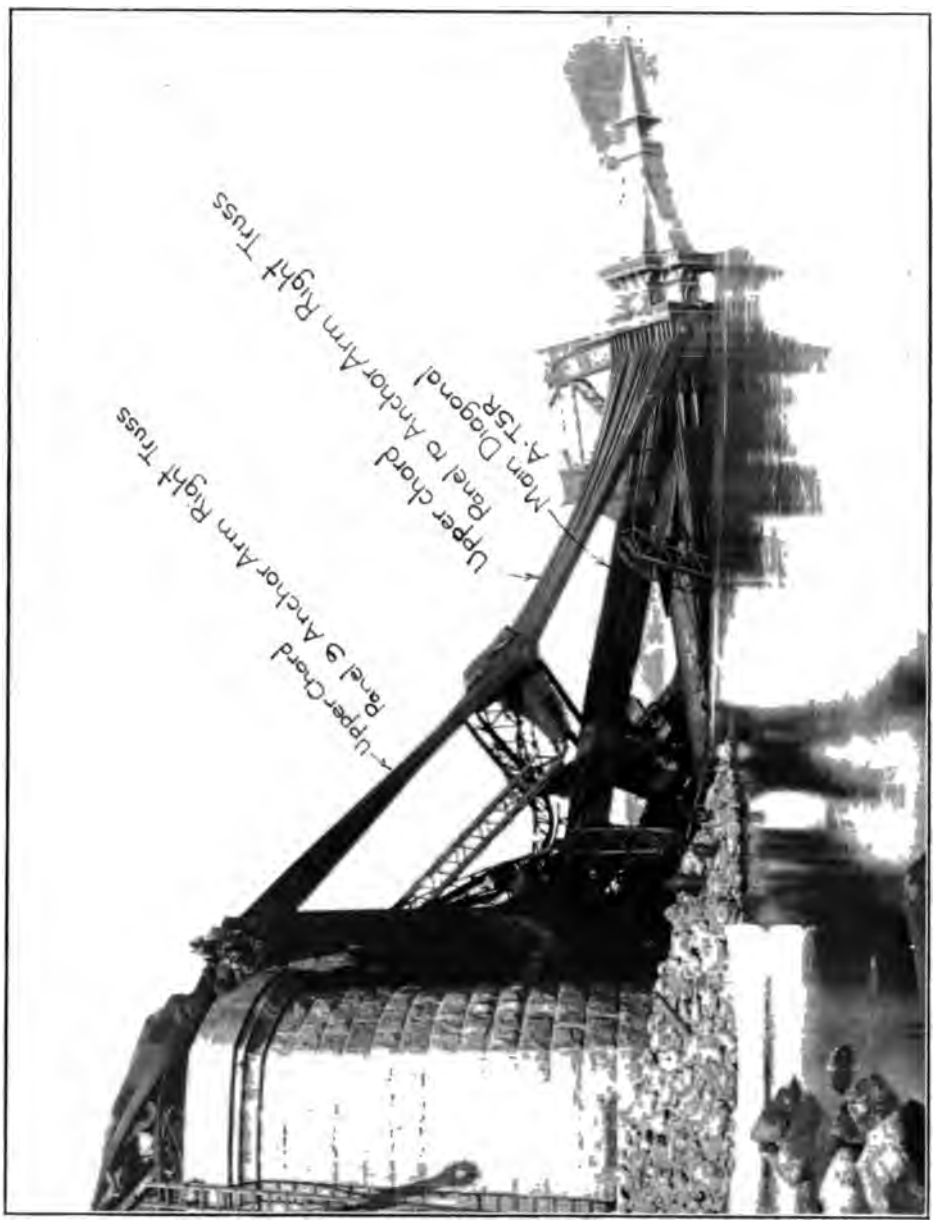
SESSIONAL PAPER No. 154

LIST OF PLANS OF BRIDGE, WITH IMPORTANT DATES—*Concluded.*

Plan No.	Description.	Date of Plan.	Date Cooper Signed.	Date Signed by Department.
11	Bottom Lat'rl Struts at HV1 for Suspen. Span ..	Jan. 10, '07..	Jan. 26, '07..	June 12, '07.
60	" " at SV3 " " ..	Feb. 25, '07..	Mar. 28, '07..	June 15, '07.
41	" " at SV2 " " ..	Feb. 4, '07..	Feb. 21, '07.	June 12, '07.
50	Top Struts T16 & T17 " " ..	Feb. 19, '07..	Mar. 28, '07..	... .
14	" " T12 " " ..	Jan. 14, '07..	Jan. 26, '07..	June 24, '07.
16	" " T13 " " ..	Jan. 23, '07..	Feb. 14, '07..	June 19, '07.
32	" " T14 " " ..	Jan. 28, '07..	Feb. 14, '07.	June 14, '07.
37	" " T15 " " ..	Feb. 1, '07..	Feb. 19, '07..	June 11, '07.
35	Strut SS2 " " ..	Jan. 30, '07..	Feb. 15, '07..	June 19. '07.
21	" SS1 " " ..	Jan. 24, '07..	Feb. 14, '07..	June 17, '07.
24	" LT13 " " ..	Jan. 24, '07..	Mar. 7, '07..	June 14, '07.
8	Hanger TOL " " ..	Dec. 28, '06..	Feb. 1, '07..	June 13, '07.
49	" TOOOL " " ..	Feb. 15, '07..	Mar. 27, '07..	June 19, '07.
22	" TOO " " ..	Jan. 25, '07..	Feb. 15, '07..	... ...
9	Top Chord Sec'ts A, R & L " " ..	Dec. 21, '06..	Jan. 26, '07..	June 13, '07.
17	" " " C, R & L " " ..	Jan. 22, '07..	Feb. 6, '07..	June 20, '07.
12	" " " B, R & L " " ..	Jan. 28, '07..	Feb. 1, '07..	June 20, '07.
18	" " " D, R & L " " ..	Feb. 5, '07..	Feb. 21, '07..	June 17, '07.
19	" " " E, R & L " " ..	Feb. 14, '07..	Mar. 28, '07..	June 17, '07.
26	Bottom Chord Sec'ts O " " ..	Jan. 27, '07..	May 10, '07..	June 14, '07.
29	" " " 2 " " ..	Mar. 5, '07..	May 10, '07..	June 14, '07.
27	" " " OO R & L " " ..	Feb. 22, '07..	May 10, '07..	June 13, '07.
28	" " " 1 " " ..	Feb. 9, '07..	May 10, '07..	June 13, '07.
30	" " " 3 S, R & L " " ..	Mar. 13, '07..	Apr. 12, '07..	June 17, '07.
46	Upper Sec'ts of 3 N, R & L Post P1 " ..	Feb. 12, '07..	Mar. 1, '07..	June 29, '07.
54	" " Post P2, Susp. Span.....	Feb. 19, '07..	Mar. 21, '07..	June 17, '07.
42	Lower " " P1, "	Feb. 7, '07..	Feb. 26, '07..	June 18, '07.
53	" " " P2, "	Feb. 20, '07..	Mar. 21, '07..	June 13, '07.
9	Elec. R'y Stringers for "	Jan. 12, '07..	Feb. 26, '07..	June 12, '07.
11	" " " "	June 16, '07..	Feb. 26, '07..	June 13, '07.
12	" " " "	Jan. 18, '07..	Feb. 26, '07..	June 14, '07.
13	Roadw'y " " "	.....	April 12, '07..	June 13, '07.
15	" " " "	Feb. 6, '07..	April 12, '07..	June 13, '07.
17	" " " "	Feb. 9, '07..	April 12, '07..	June 13, '07.
2	Railw'y " " "	June 21, '06..	June 26, '07..	June 13, '07.
3	" " " "	July 3, '04..	Feb. 26, '07..	June 13, '07.
6	" " " "	Dec. 15, '06..	April 12, '07..	June 13, '07.
7	" " " "	Dec. 21, '06..	April 12, '07..	June 13, '07.
5	" " " "	Dec. 7, '06..	April 12, '07..	June 14, '07.
13	Sub-vert SV1 " "	Jan. 9, '07..	Jan. 26, '07..	June 24, '07.
36	" SV2 " "	Feb. 1, '07..	Feb. 15, '07..	June 19, '07.
52	" SV3 " "	Feb. 20, '07..	Mar. 27, '07..	June 13, '07.
44	Sub-Diagonal, SP2 " "	Feb. 9, '07..	Feb. 15, '07..	June 24, '07.
15	" SP1 " "	June 12, '07..	Feb. 1, '07 .	June 13, '07.
51	" SP3 " "	Feb. 18, '07..	Mar. 27, '07..	June 17, '07.
67	Diag'nl T3 " "	Mar. 4, '07..	Mar. 30, '07..	June 12, '07.
71	" T3OS & T3ON "	Mar. 12, '07..	Mar. 30, '07..	June 17, '07.
19	Floor B'ms FB3 & FB5 "	Mar. 1, '07..	May 10, '07..	June 11, '07.
16	" FBO & FB1 "	Feb. 11, '07..	April 13, '07..	June 13, '07.
19	" FB2 & FB4 "	Feb. 15, '07..	April 13, '07..	June 14, '07.
8	Bracing Shims in Cen. for R'y Stringers Susp. Spn	Dec. 31, '06..	May 10, '07.	June 12, '07.
21	Shims for Susp. Span	Mar. 20, '07..	May 10, '07..	June 14, '07.
4	Variation betw. Chords & Stringers for var. loading Sus. 1 Span	Nov. 22, '05..	Jan. 15, '07..	June 13, '07.
70	Bottom Chord Secs. S4 & L. South ½ Susp. Sp...	Mar. 15, '07...	June 11, '07..	June 26, '07.
69	" Strut SM4L for Suspen. Span....	Mar. 11, '07...	June 11, '07 .	June 26, '07.
3	Eye-bars in bottom Chord "	Mar. 13, '07...	June 11, '07..	June 26, '07.
2	Pins, Caps, Washers, &c "	Mar. 6, '07..	June 11, '07..	June 26, '07.
63	Lower Sec's of Post P3 "	Mar. 2, '07..	June 13, '07..	July 2, '07.
64	Upper " "	Feb. 27, '07..	June 13, '07..	June 27, '07.
68	Strut LT17 " for " ...	Mar. 5, '07..	June 13, '07..	June 27, '07.
59	Struts SS3 & SS3x " "	Feb. 26, '07..	June 13, '07..	June 28, '08.
20	Top Chord Secs. FSRL & FN " ...	Feb. 22, '07..	June 13, '07..	July 3, '07.
3	Pins, Caps, Pilots in Cen. for "	Mar. 9, '07..	June 13, '07..	June 27, '07.

EXHIBIT No. 34

EXHIBIT No. 34



1. View showing the centre post cap, finials, diagonal T5 and the upper chords in panels 9 and 10 Anchor Arm. The centre post has been practically bent double over the main pier by the drag of the cantilever arm. Note that the end of the pier is clear of wreckage.

2. View from the east of wreckage inside the main pier. Note the condition of CP5 which is standing in the hole dug by the shoe ; the wreck of CP4 across the top of the pier and the thrusting of P4 inside CP.

3. View from the east at the 9–10 R joint in the lower chord. Note how 7R and 8R have been thrust over 9R and 10R. This view is almost identical with one taken by Mr. Kinloch.

4. View of the same from a further distance Note the distortions of ALP3R.

5. View of the top of post P2R.

6. View of the foot of post P2R. Note the distortions of ALP2R, ASP2R and AUP2R, making one complete post.

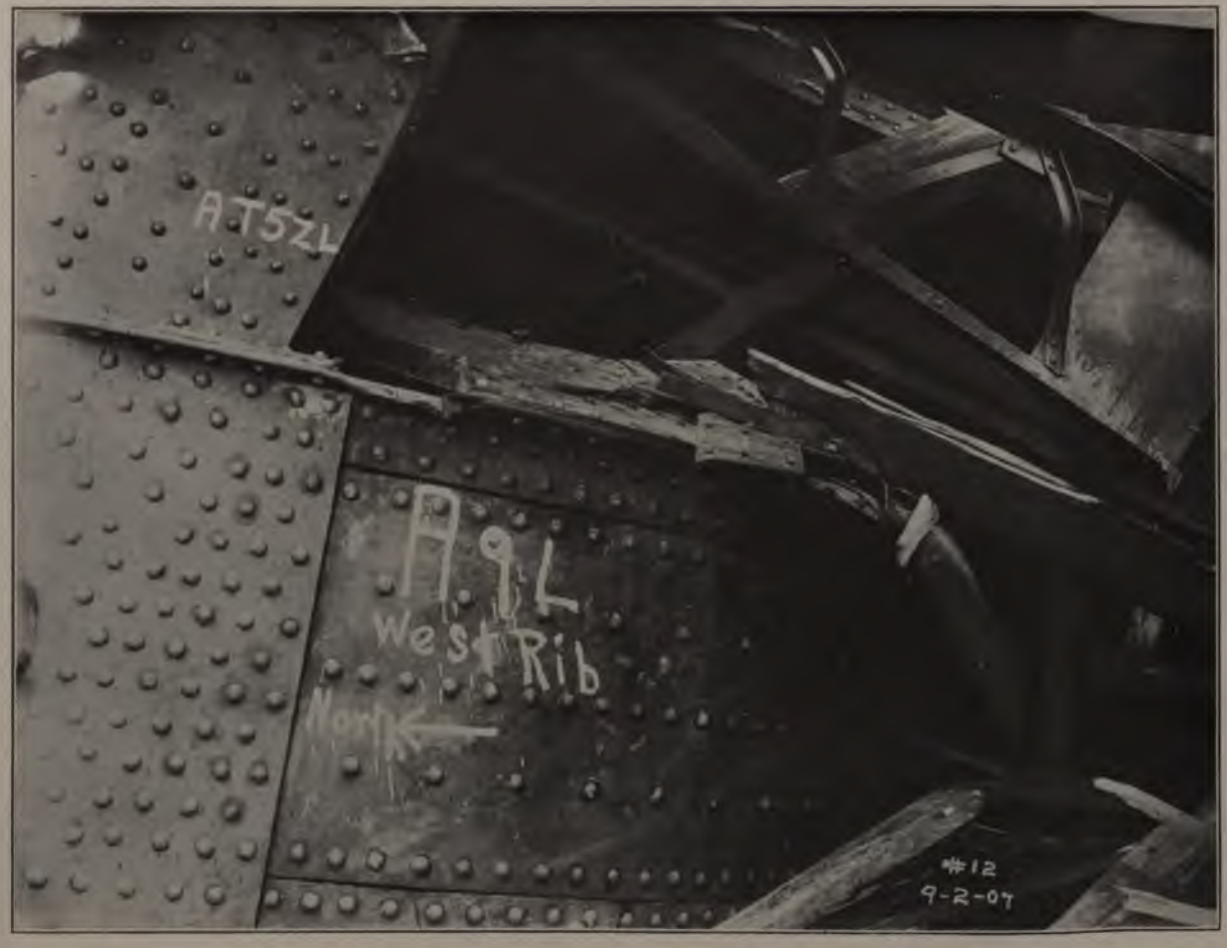
7. View near the top of post P1R. Note the line of the diagonal eyebars AT1, and the top chord eyebars AA.

8. View with the foot of EPR on the left. Note the buckling of chord A1R. Other views of this member are to be found in Exhibit 35 and Appendix No. 12. Note the stringer system. ASP1R in the foreground has been twisted and has got in between the webs of A2R which is lying nearly at right angles to its original position.

9. View from the west of the wreckage inside the main pier. Note the twisted web of A8L; the lower end of post P4 inside CP6L; the splice plates between A11L and 10L cantilever arm; CP5L; and the spawling of the masonry coping which was struck by A11R.

10. View from the west near the anchor pier. Note the tower shells, the anchor bolts pulled out of the masonry, and the broken tenon girder which transmitted the horizontal wind reaction to its anchorage.

11. View looking north showing part of the 180° bend in the north (original) end of A9R. Note the position of A7R.



12. View from the west showing the beginning of the first 180° bend in chord A9L.

13. View showing the foot of post P3L. Note the distortion of this post and the effect of the foundation holes on the lower chords.

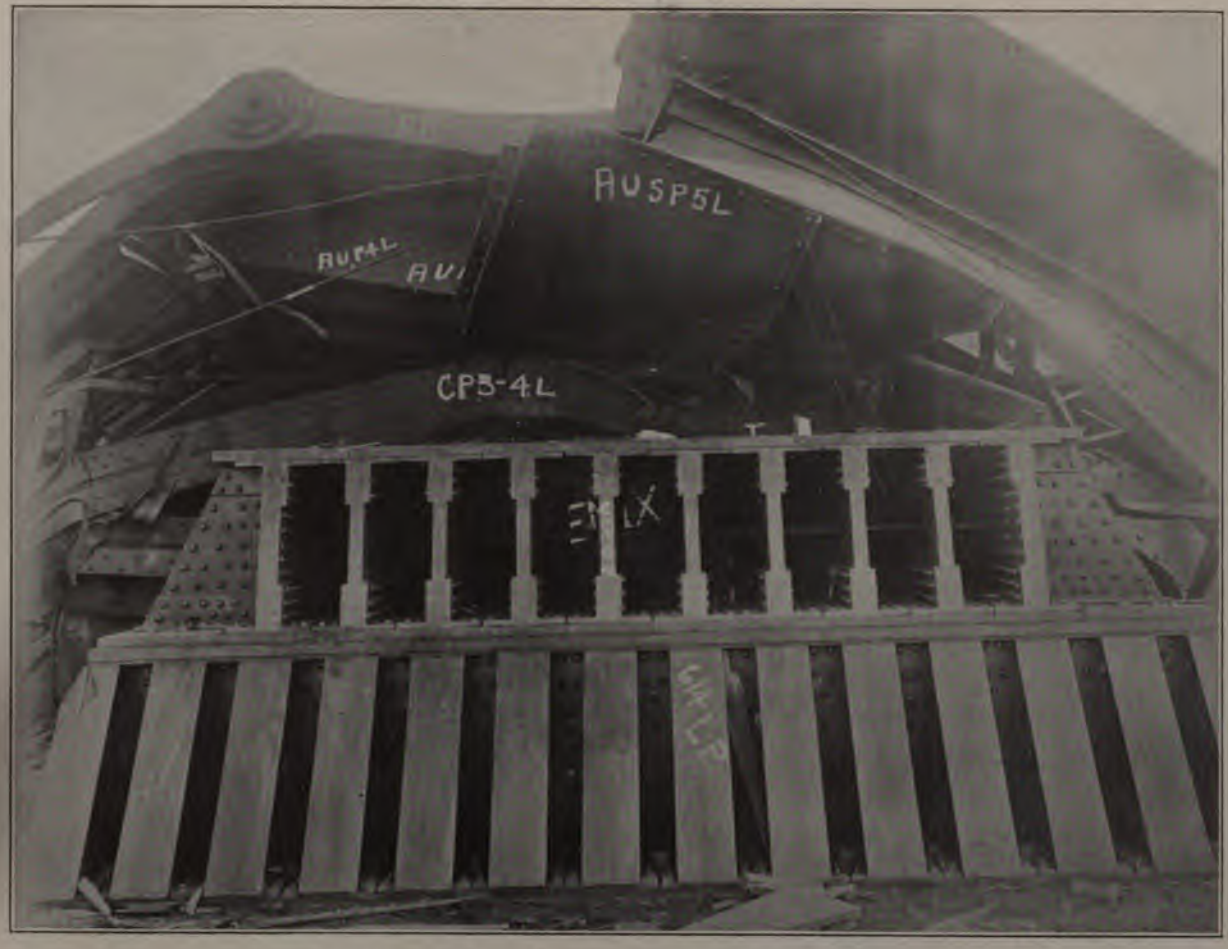
14. View showing the foot and hanger AT000L and the top of post AUP2L. Note that the outer movement of the upper chord with reference to the lower chord is almost exactly one panel length.

15. View showing the foot of post P2L. Note how the ribs of ASP2 cut the cover plate of A4L at some stage of the fall ; the camber block in the foreground ; and the condition of the link connecting AT2 and AT20.

16. View showing the wreck of the portal. Note the fracture of the splice plates between A3L and A4L.

18. View from the west with the foot of EPL to the extreme right.

18. View from the west with the foot of EPL to the extreme right.



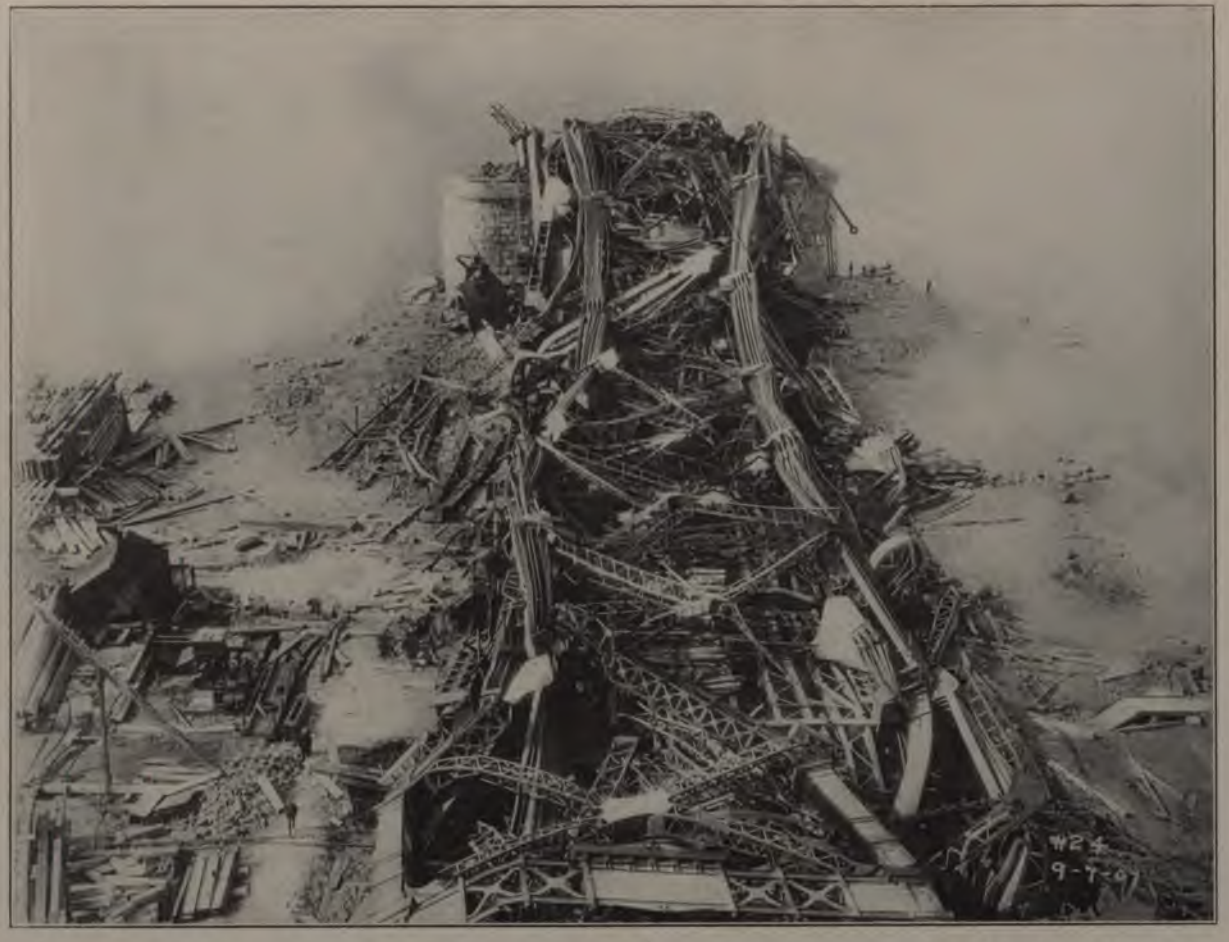
19. View of the left pedestal, main pier, which remain in place.

20. General view from the main pier southwards. Note the moderate damage to the upper laterals.

21. General view looking towards the main pier. Note the upper chord in the right.

22. General view from the anchor pier northwards. Note the position of the wreckage on the main pier.

23. General view from the bank looking northward.



24. General view from the anchor pier northwards, same as No. 22, but from a different elevation. Note the unbroken lines of the upper chord.

25. View of the anchorage of the right truss. Note the bendings of the anchorage bars; the scaling of the metal in them, and the folding and scaling of the tower shell.

26. View of the anchorage of the left truss.

EXHIBIT No. 35

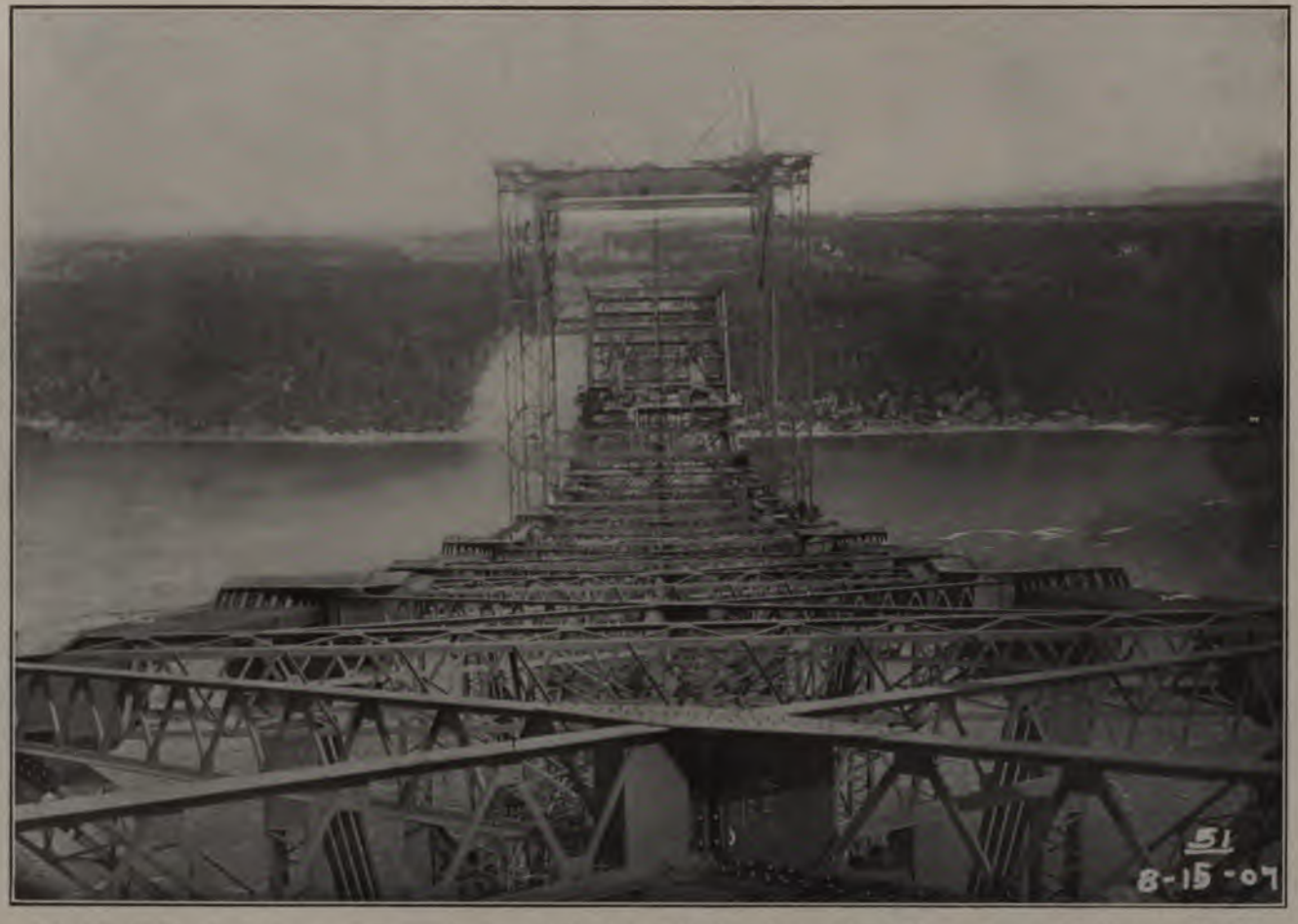
1. View of the end posts, anchor tower, and part of the first three panels of the left truss of the anchor arm. Note the rivetting scaffolds under the lower chord joints. Date, May 22, 1907.

2. View of lower chords A 8 R and A 9 R anchor arm. Note the arrangement of the connecting members and the bolting of the 8-9 splice.

3. View of the upper part of the steel false work and of the "camber blocks" used in adjusting the elevations of the panel points. Date, May 19, 1907.

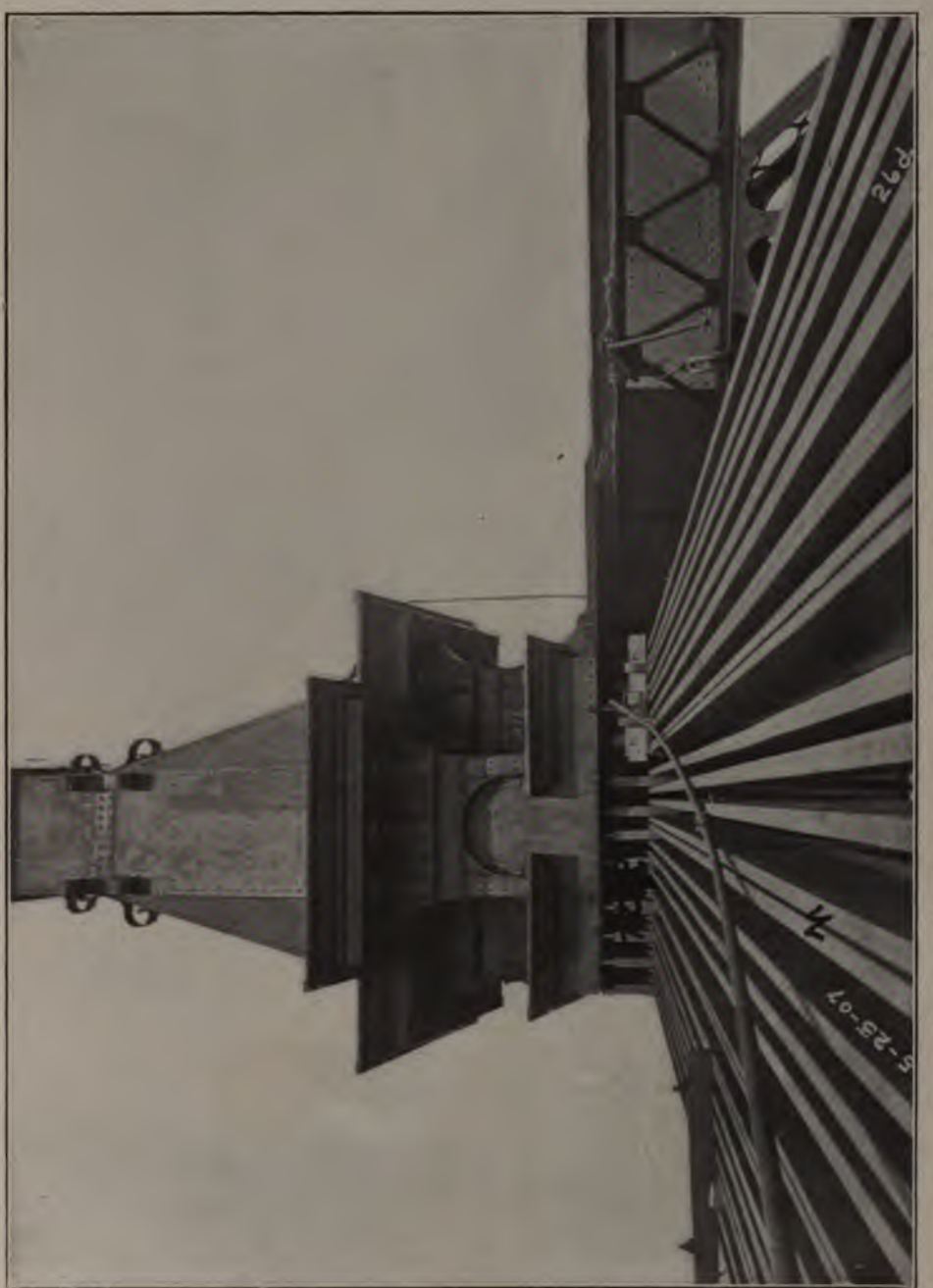
A60L
A60U
A60L
A60U
A60L
A60U

5. View of the upper chords and lateral bracing panels 5 to 10, cantilever arm. Date, August 15, 1907.



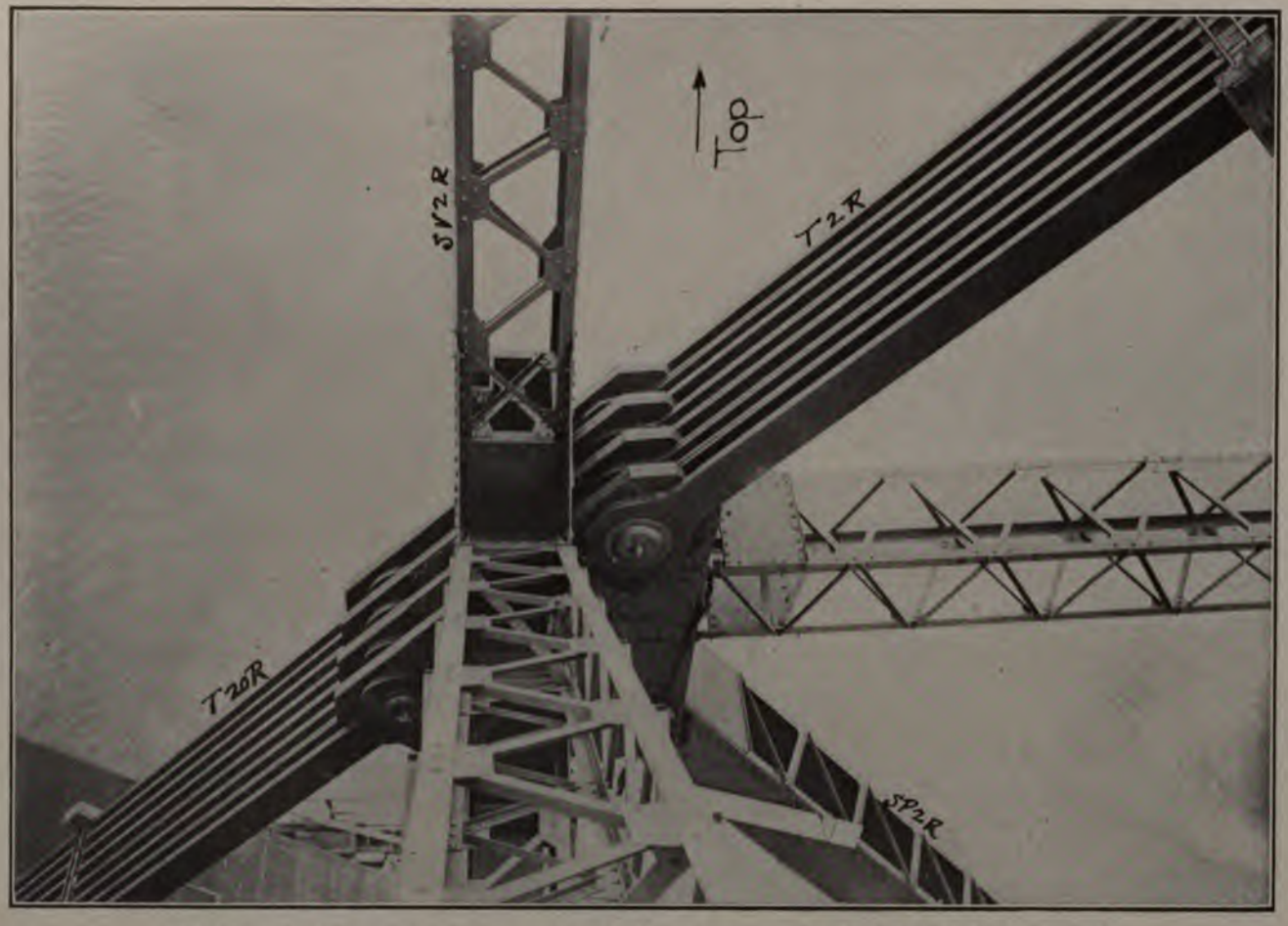
6. View looking from the centre posts over the upper chords out towards the small traveller which is erecting and the big traveller which is being dismantled. Date, August 15, 1907.

7. View of the centre post cap and connections, right truss. Date, May 18, 1907.



8. View of the upper chord and centre post final, right truss. Date, May 23, 1907.

9. View of the eye-bars in panel 8, cantilever arm, left truss. Date, May 18, 1907.

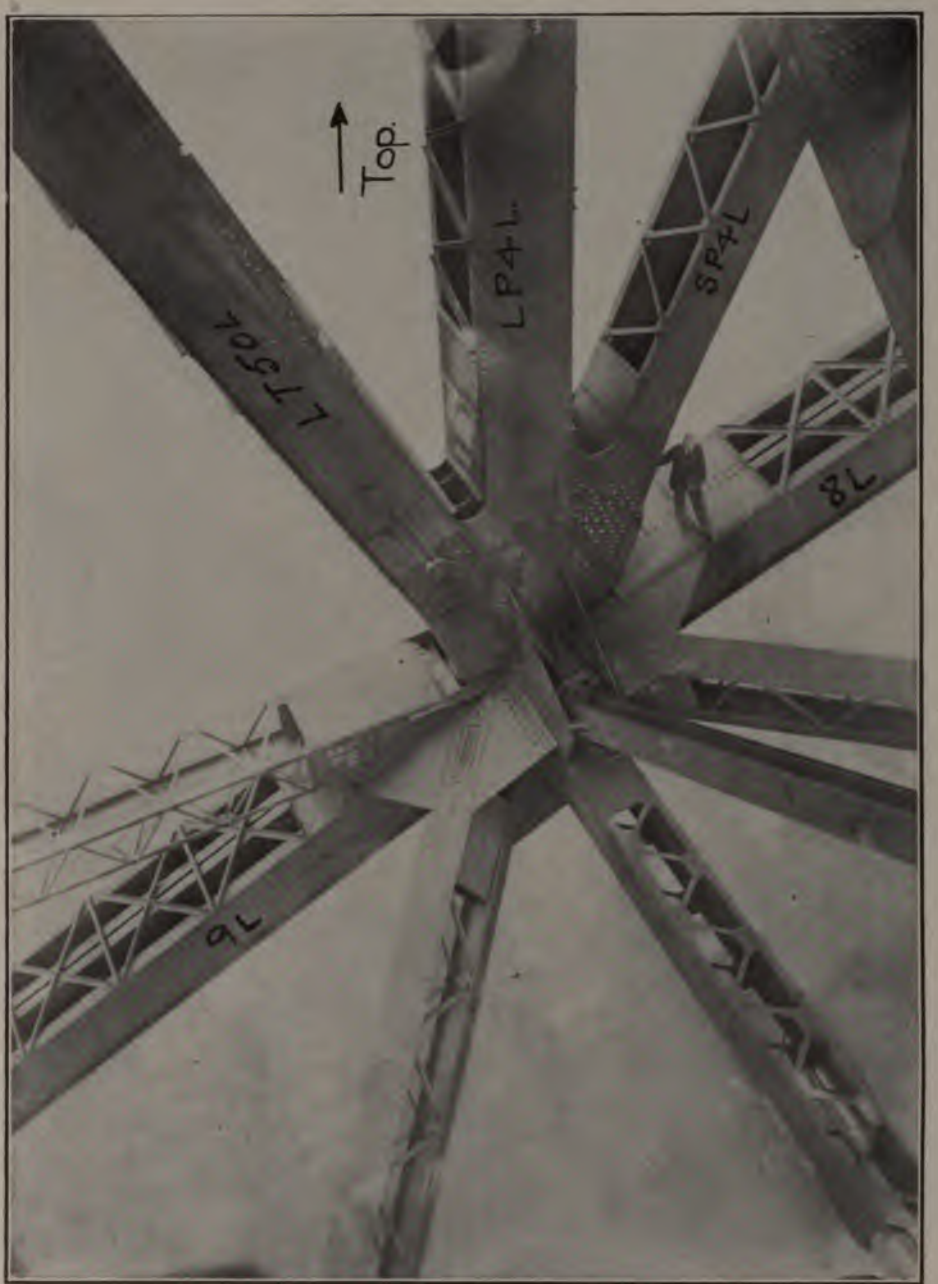


10. View of web intersection between panels 3 and 4, anchor arm. Note the double pins in the diagonal T–2 and T–20 and the connecting links.

11. View of upper chord intersection between panels 4 and 5, cantilever arm. Note the detail at the top of the post P-2, and the framing of the lateral and sway bracing. Date, May 18, 1907.

12. View of web intersection between panels 9 and 10, anchor arm, right truss. Note the joint in the main diagonal, T-5—T-50. Date, June 12, 1907.

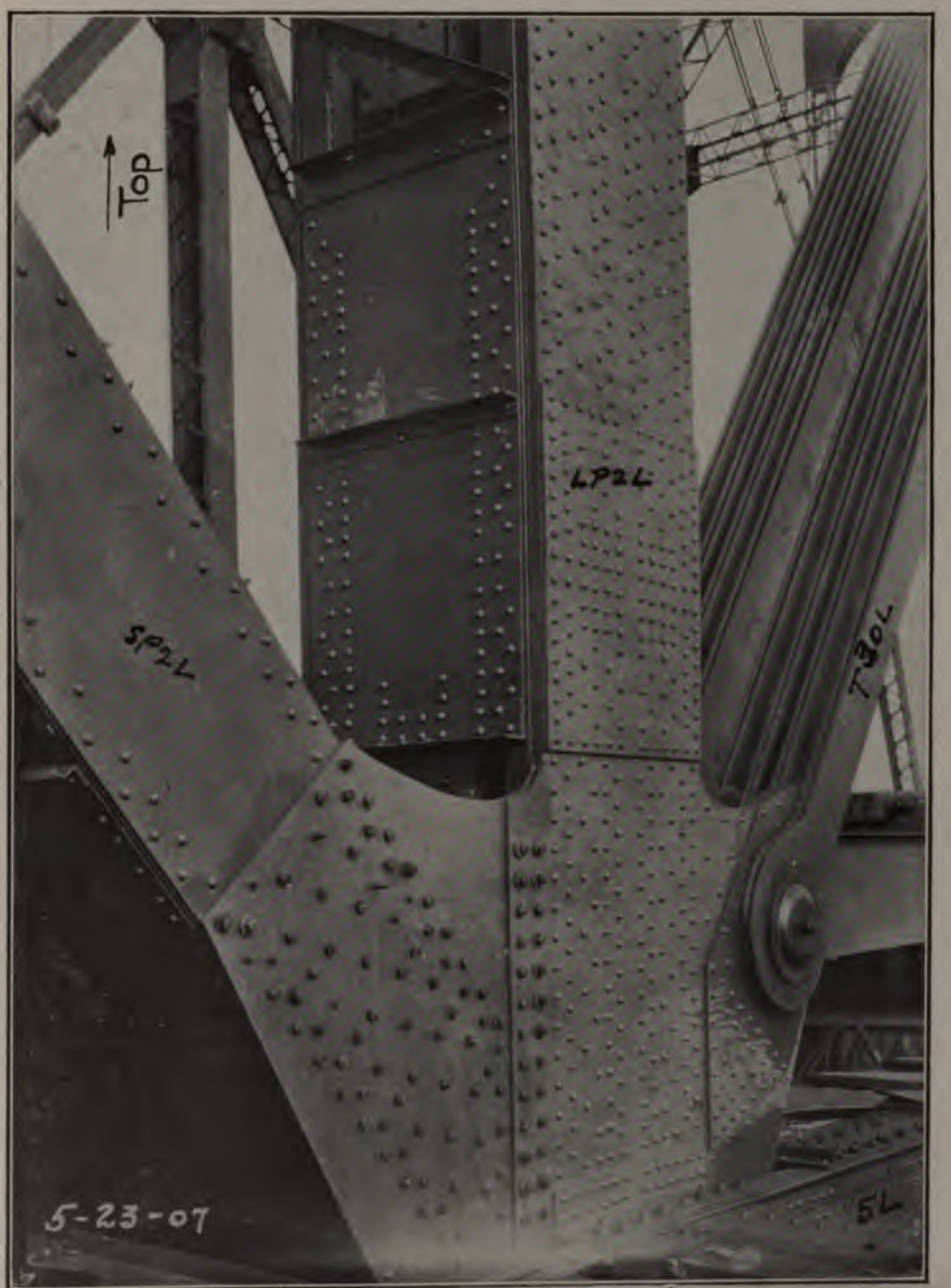
13. View of part of the centre post, left truss. Note the framing of the double sway bracing strut.



14. View of bottom chord intersection between panels 8 and 9, cantilever arm, west truss. The lower chords on the opposite truss (8-R and 9-R) are duplicates of those shown and were failing on August 27.

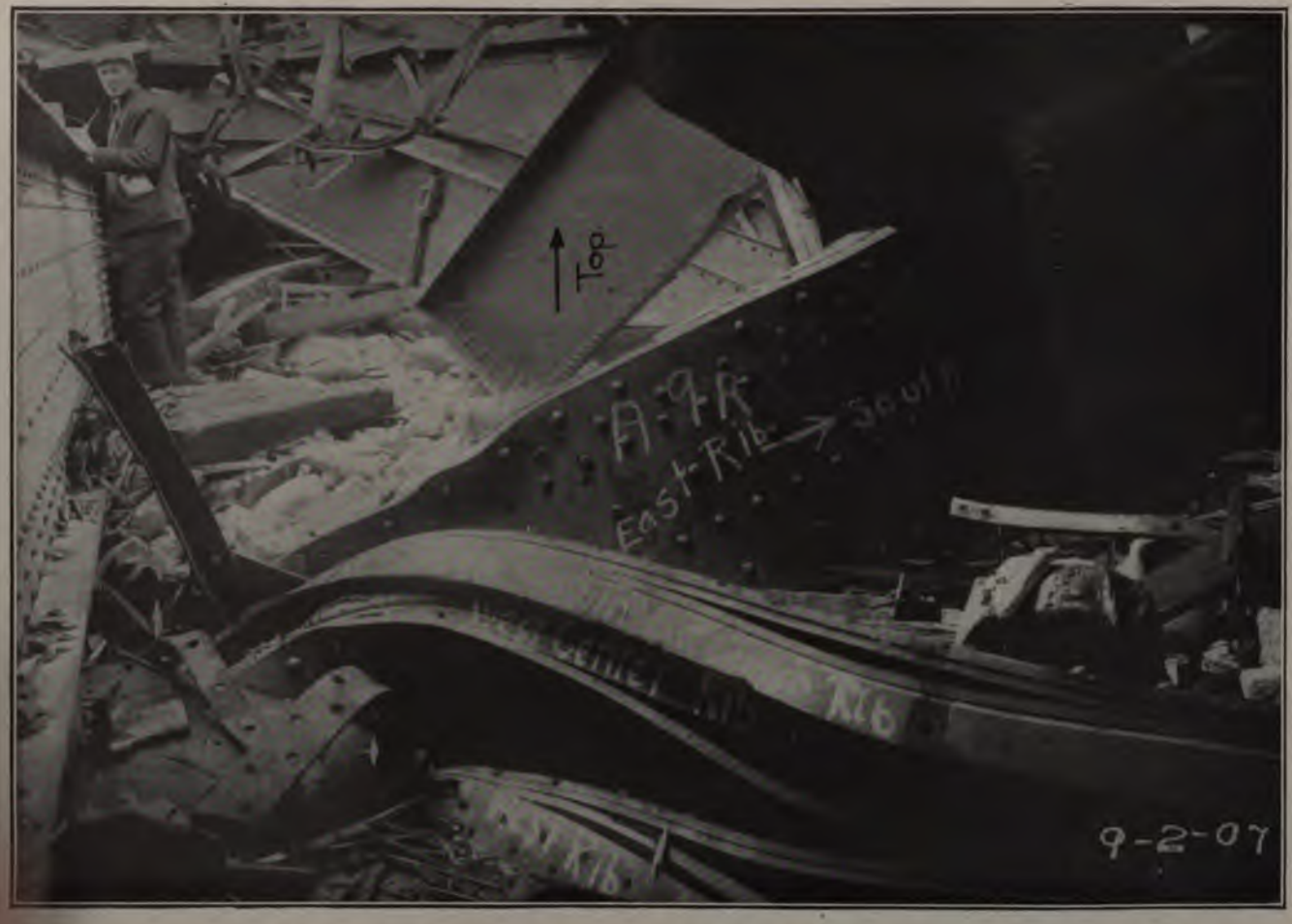
15. View of web intersection between panels 3 and 4, cantilever arm, left truss.
Date, June 12, 1907.

Top.
A7
A11
A1
A0
A1
A0
A1
A0



17. View of the foot of post P-2, left truss, cantilever arm. Note the bolting of the splice joint. Date, May 23, 1907.

18. View of the shop splice between panels 9 and 10, left truss anchor arm. Note the bend in chord A 9 L. Date, Sept. 2, 1907.



19. View of the wreckage of chord 9, right truss anchor arm. Note the bend of the ribs which is nearly 180 degrees near the lattice bar in the foreground, and the chord has been turned upside down. The lower chord in the left of the photograph is A-7-R. September 2, 1907.

21. View of bend shown in 20, but taken looking north. Date, Sept. 2, 1907.

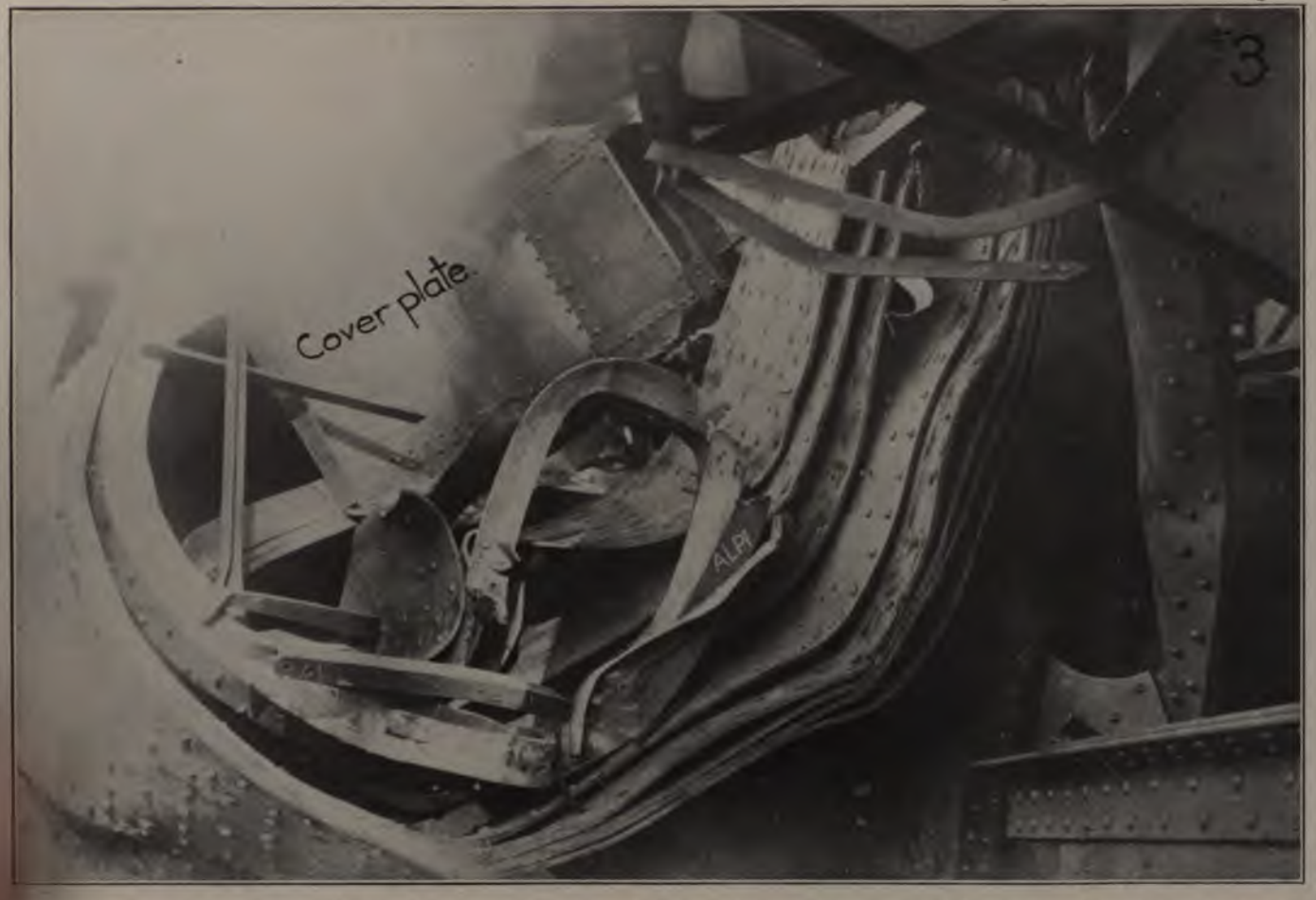
21. View of bend shown in 20, but taken looking north. Date, Sept. 2, 1907.

23. View of lower side of chord 1, right truss, anchor arm, taken looking north. Note the form into which the chord has buckled.

EXHIBIT No. 124

1. Shows buckling of chord A1R between cover plates; also efficiency of covers and diaphragms in keeping members straight. The offset from the edge of the upper cover plate in the photograph to the corresponding edge of the lower cover plate is 7′ 11″, and the offset between the two plates at right angles to the plane of the picture is 9′ 0″. The chord apparently struck the ground end on and the buckling shown resulted.

2. Shows buckling of a post having two laminated webs latticed with angles. The [illegible] strut in the foreground is part of the lateral system.



3. Shows detail of distortion of post ALP1. Note the gradual parting of the laminated webs, the distortion of the lattice angles and also the straight lines retained by cover plates.

4. Shows buckling of portion of centre post CP4R. Note also the straight lines retained by the cover plates. The centre post generally was of the same design as lower chords, being composed of four parallel webs with the addition of extra flange angles.

5. Shows typical rupture of connection of floor beam to post. This action is undoubtedly of the fall. Note the general uniform strength of the joint as indicated by the failur ways of the floor beam connection angles, and also of the rivets. In this instance, wh failed they yielded by direct tension, and almost without exception necked dowr manner as a perfect tension specimen pulled in the laboratory.

6. Shows the unbroken chain of eye-bars of the top chord of the Quebec side designated on the plans as AdR, AeR and AfR.

7. Shows the one bent pin in the débris, being the pin between top chord members AdL and AeL. This photograph also shows the only broken eye bar, which will be observed resting on a built-up member at the lower right hand side of the picture. The head of the bar was thrown about 15 feet to the left. There is every evidence that the blow which caused the damage to the webs of the post below the pin also bent the pin and broke the eye-bar.

8. Shows a remarkable test of the quality of steel in the eye-bars. This bar was one of a set of main diagonals, and its body was 1⅝" x 15". The forces set up by the fall twisted the body of the bar through an angle of 90 degrees in a distance of about 2½ feet while the head of the bar still remains in its original position on the pin There is no evidence of any failure of the bar on the accessible surfaces.

9. Shows 1⅞ inch anchor bolts which held the foot of each shell surrounding the eye-bar anchor rods at the top of the anchor pier. These bolts were ordinary steel rods, 4 feet 6 inches long, and swedged every three inches on opposite sides. The holes in which they were set were drilled in the granite. The bolts were supposed to have been grouted in with pure Portland cement. In every case where they received direct tension they pulled bodily out of the masonry.

10. Shows the complete chaos to be seen at some points of the wreckage. This view is interesting only as an indication of the magnitude of the forces at work during the catastrophe. Even in this distorted mass there is no evidence of poor material.

11. Shows the folding of the plates of the shell containing the anchor eye-bars on the anchor pier. The folds in this instance resemble in every way the action of heavy felt under similar treatment.

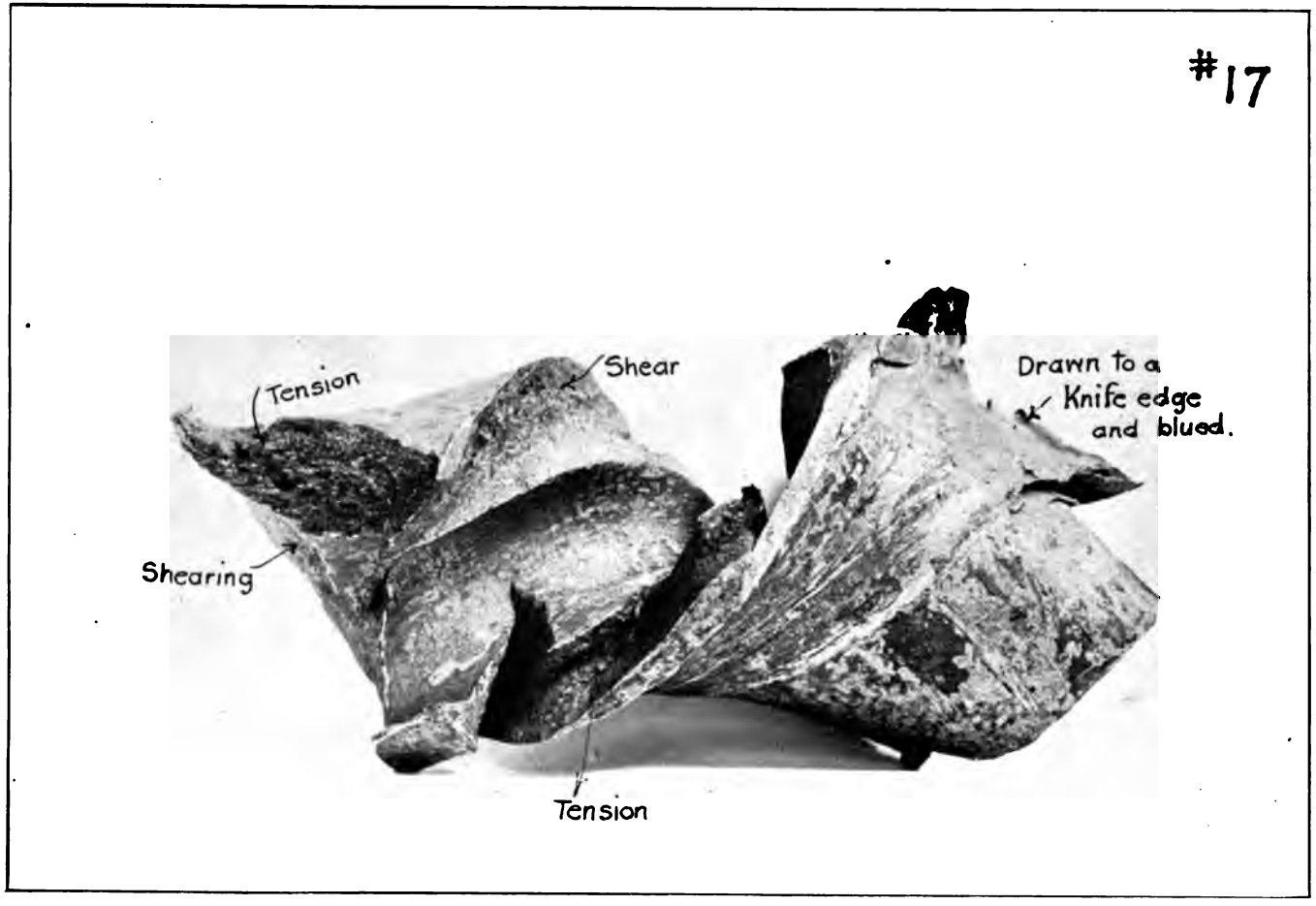
12. Shows a fragment of an angle 4″ x 3″ x ⅜″. During the progress of the fall this angle was opened flat and bent backwards nearly at right angles to the axis, and hammered down to close contact. There is in this case only a slight crack about half inch long on the exterior of the sharpest bend. Note the enlarged rivet hole. This specimen contains a rivet intact, the connecting pieces having parted from it by tearing of rivet holes.

13. Shows a fragment of an 8" x 6" x $\frac{13}{16}$" angle torn to pieces and closed together to nearly close contact.

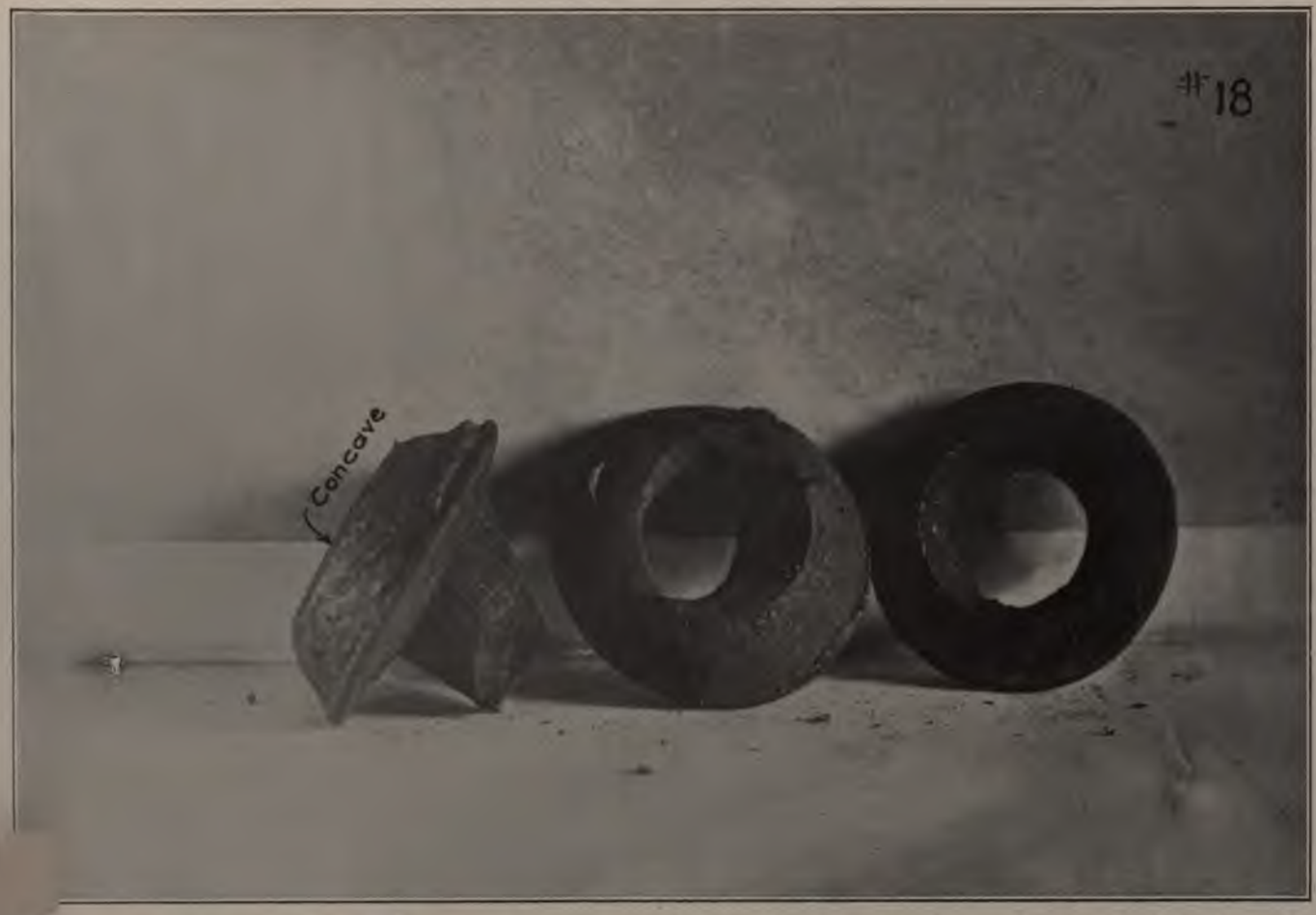
14. Shows another view of the angle shown in No. 13.

15. Shows a fragment of $\frac{7}{8}$" plate torn, sheared and bent.

16. Shows a fragment of ¾" plate torn, sheared and bent.



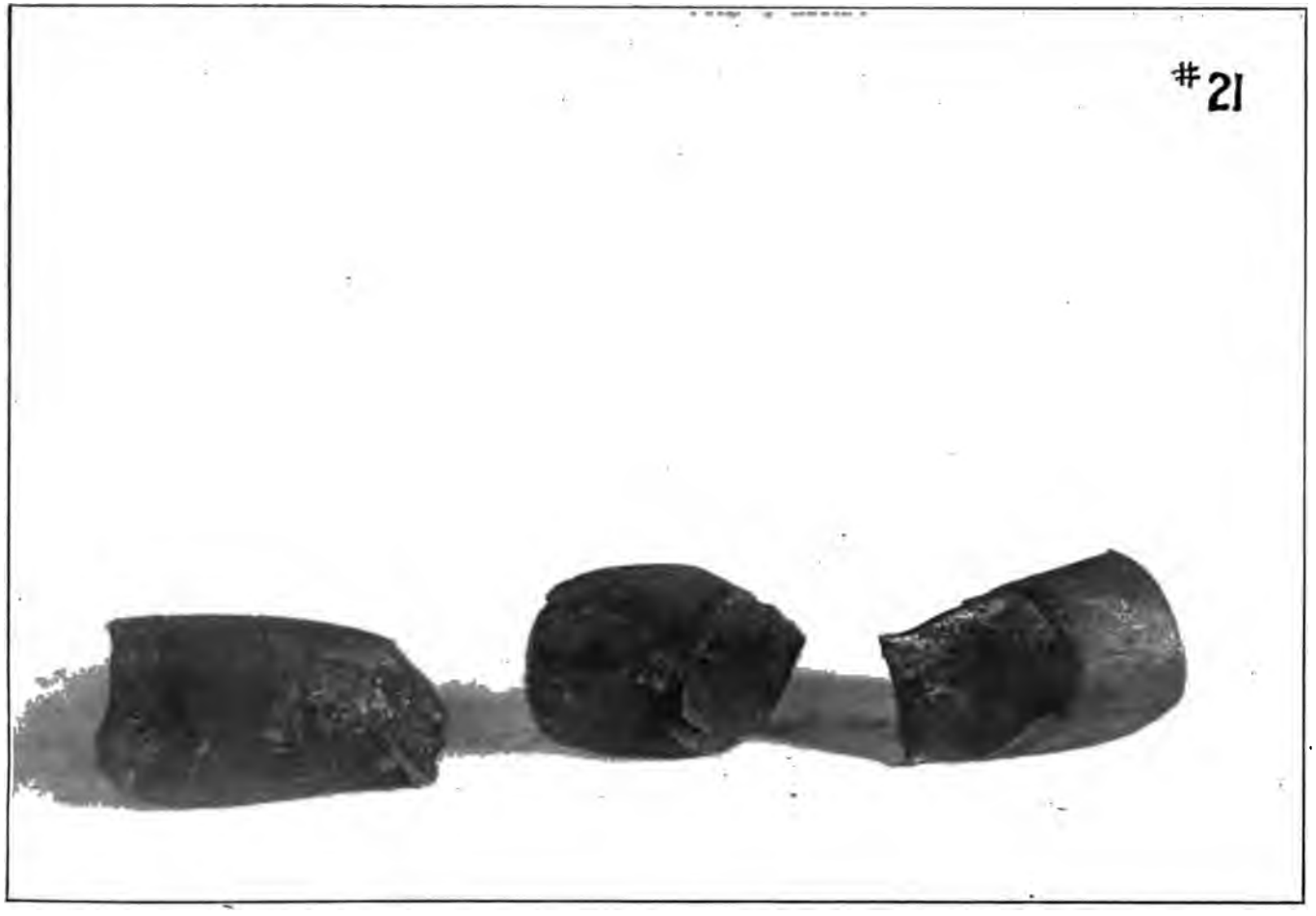
17. Shows a fragment of ½" plate originally about 2" x 6". This specimen is unique, showing clearly its quality by having been bent spirally as if a three-eighths rod had been used for a core about which to bend it. It also exhibits a beautiful fracture from shearing. It has a perfectly fibrous fracture from failure in tension. Its ductility is proven by a terrific sliding force which indented and scored it throughout its whole length and finally drew it to a knife edge. This action set up so much heat that the specimen is perfectly blued at this last named point. This specimen is photographed to exact size.



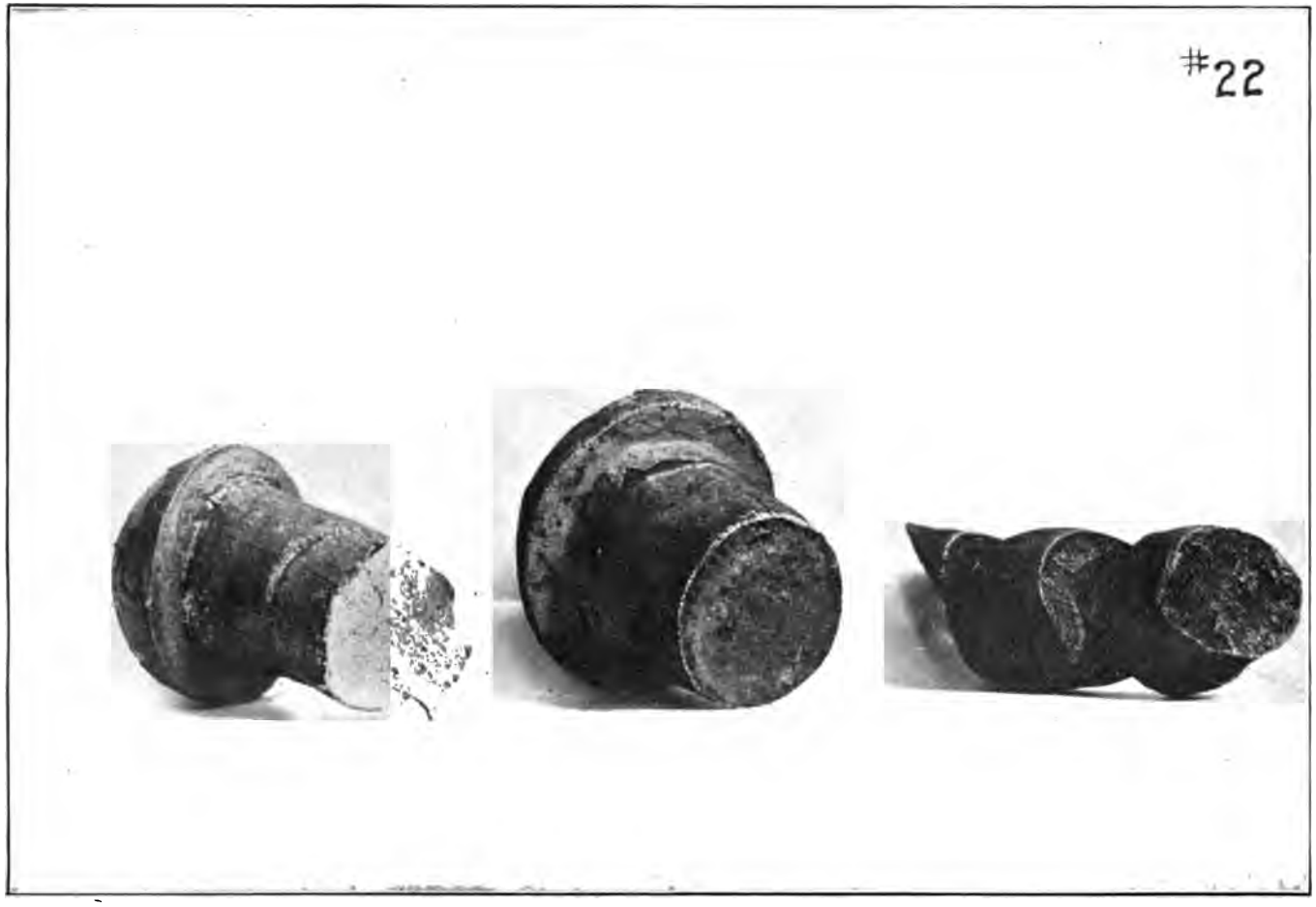
8. Shows three typical rivet failures. One where the shank pulled out of the head leaving a perfect ring; another where the shank did not pull evenly out of the head, but left a flat portion on one side of the circle, (note the concave surface of the segment due to the flow of metal in the pulling) and a third, a rivet head in which failure started by the shank pulling through the head, but finally fracturing by drawing down a small area and showing a cup fracture by tension. The concave surface in the head is the result of the flow of the metal during the pulling of the shank through the head.

19. Shows three rivets in which the component members of the joint in which they were driven each started to shear the shanks. The outer one finally completing the shear. The middle rivet of this group shows a failure by direct tension. (Note the reduction in area of the shank).

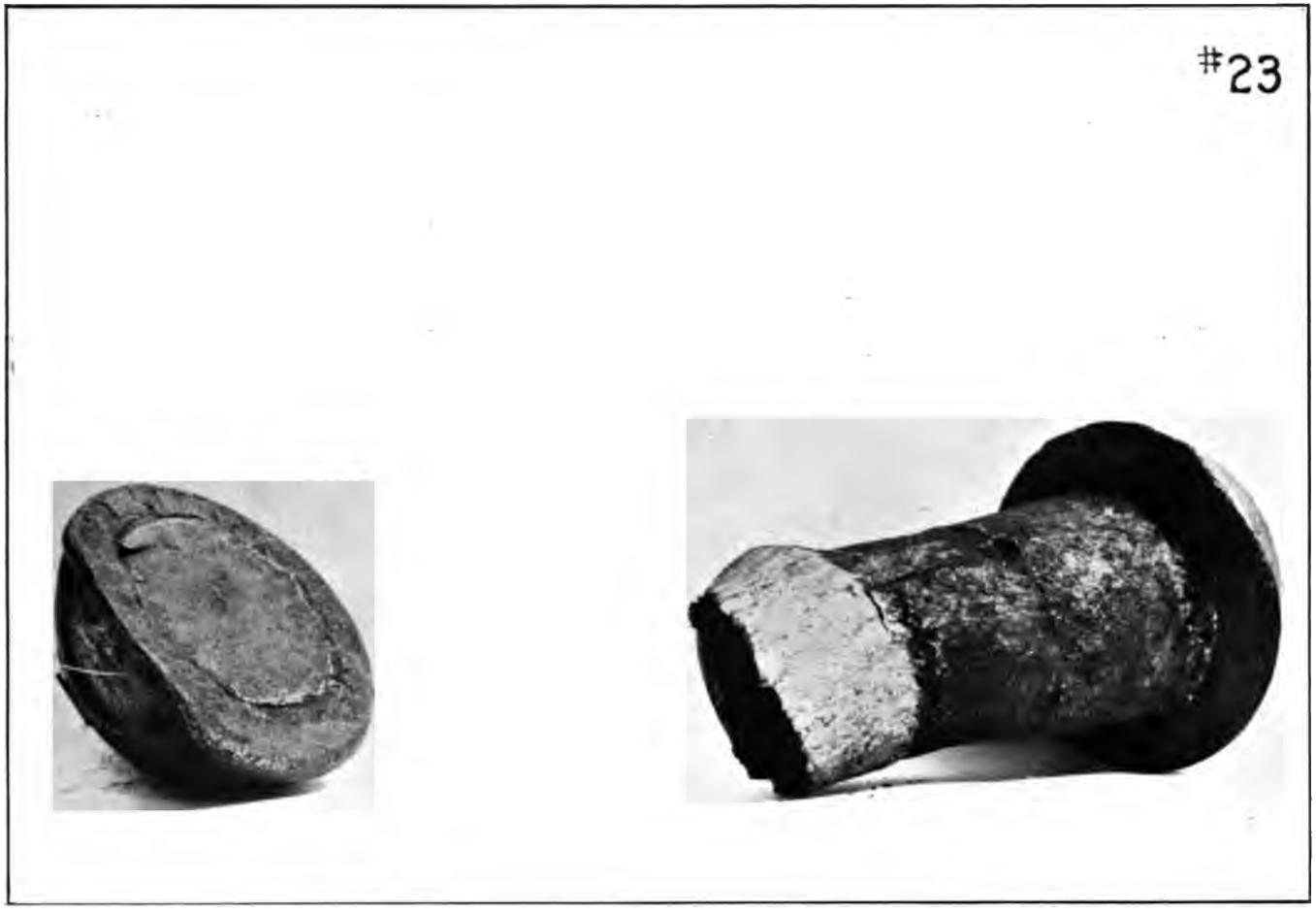
20. Shows a rivet head which has been sheared close under the shoulder and finally flattened by grinding blows. This photograph also exhibits two rivet heads which have been distorted and flattened, and caused to flow over half inch in one direction without shearing. There is also shown on this picture a countersunk rivet which yielded by direct shear.



21. Shows fragments of rivet shanks, the centre one being sheared at both ends, the other two being sheared at one end and pulled at the other.



22. Shows two rivets having typical shears in shank; it also shows a piece of rivet shank distorted beyond recognition by tension and shearing.



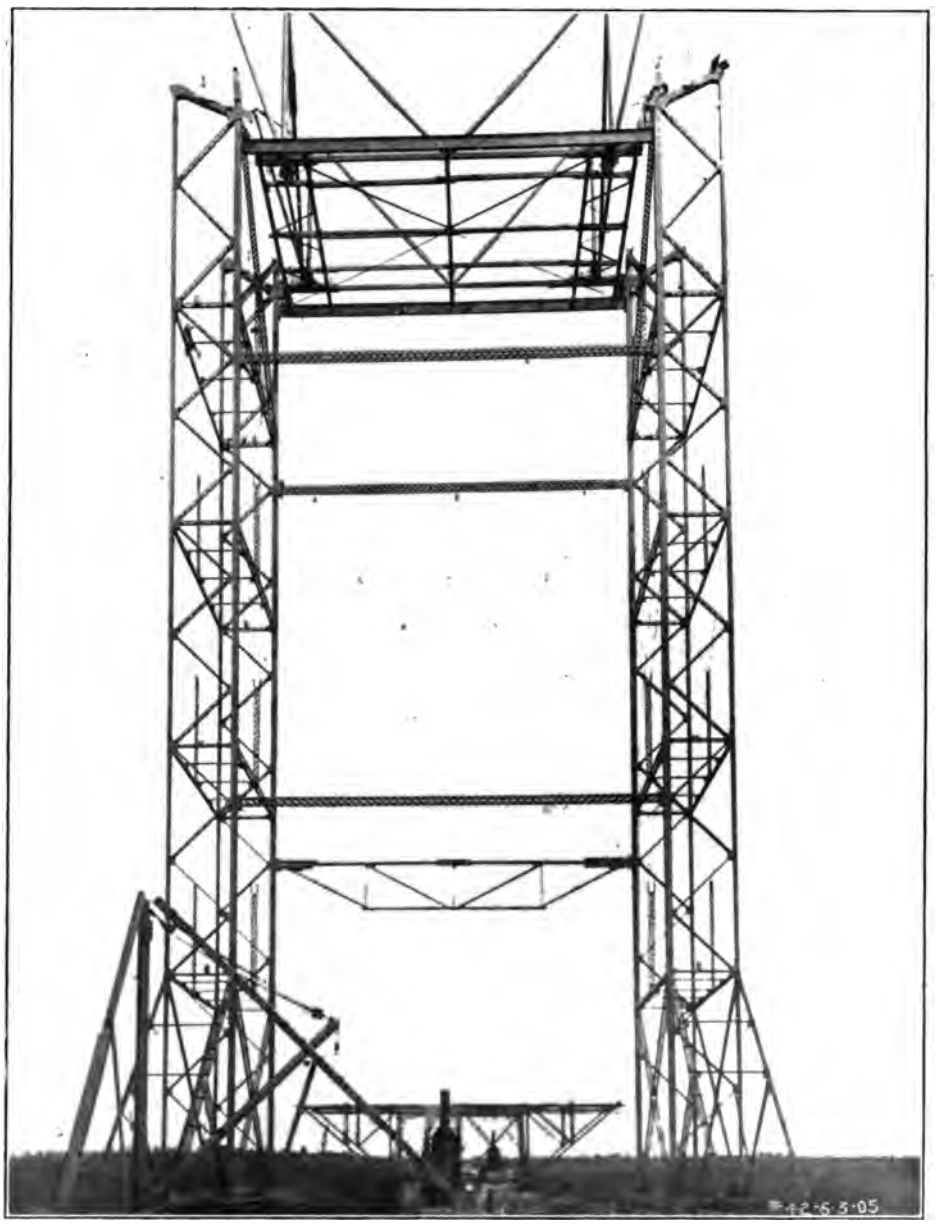
23. Shows a perfect rivet head which has been sheared immediately under the shoulder by a heavy side blow. It also shows a rivet the shank of which has been pulled out of the head, leaving a ring such as are shown on photograph 18. The rivet specimens shown on photographs 18 to 23 are nearly all $\frac{7}{8}$ inch. A few are one inch. The latter are commonly found destroyed by simple shear, as the type of joint in which they were employed generally produced this action during the disaster.

EXHIBIT No. 126

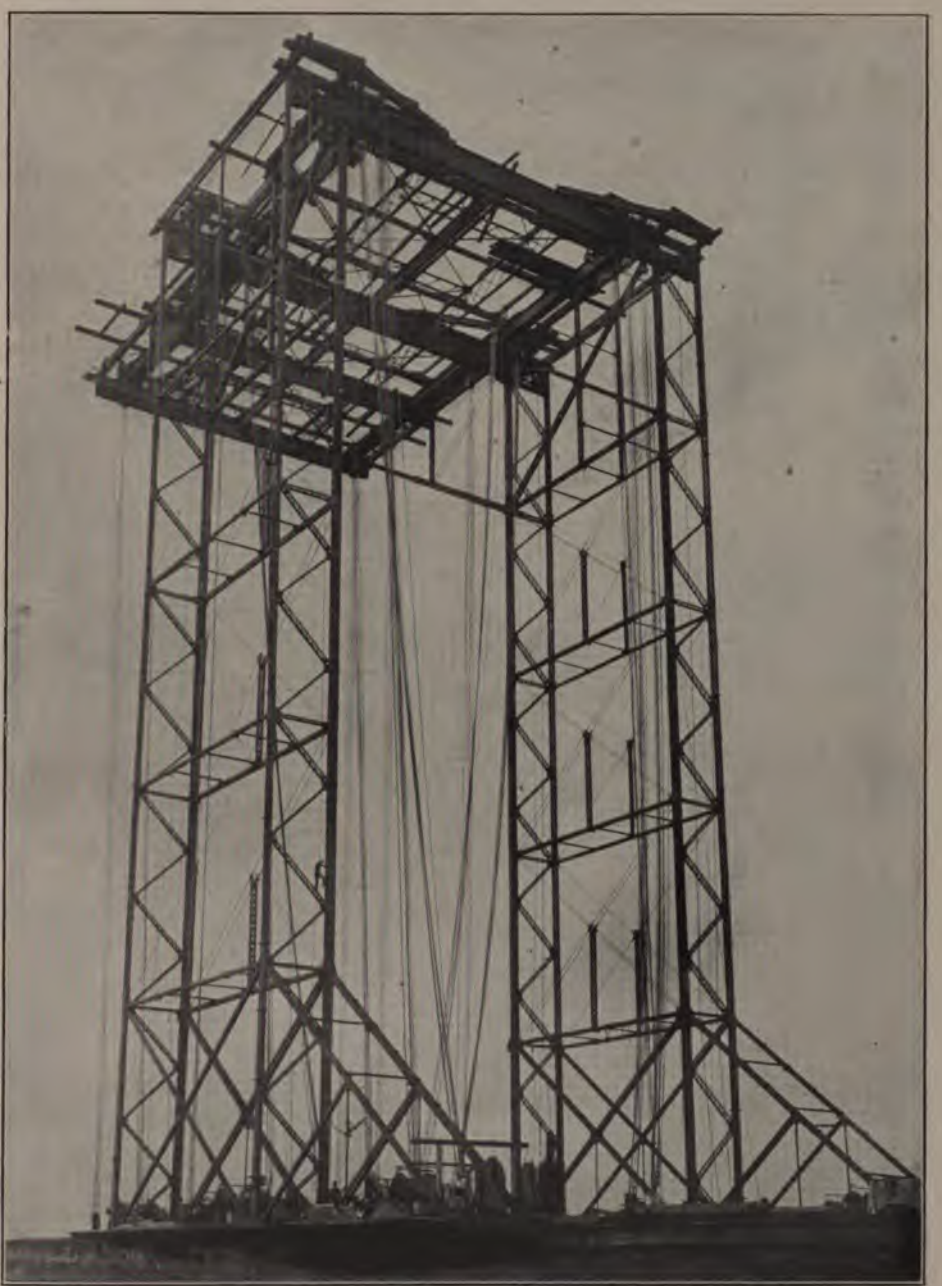
1. View of the Chaudière Storage Yard. Date, March 28, 1906.

2. View of Belair Storage Yard. Date, August 19, 1907. Note the overhead cranes for loading and unloading material.

3. View of Belair Storage Yard. Date, August 19, 1907.

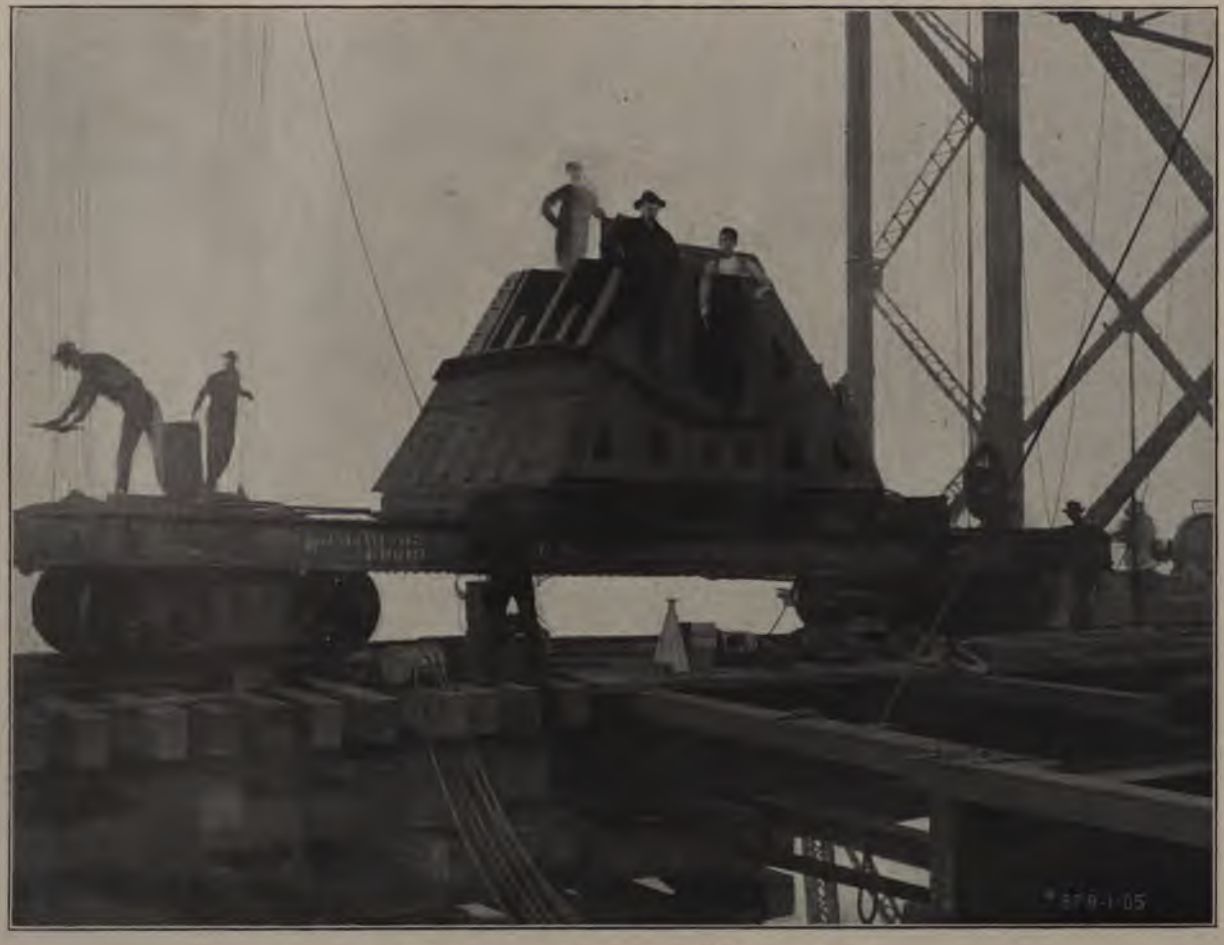


4. View of big traveller while in course of erection. Date, June 3, 1905. Note the erecting platform which is lifted step by step as the traveller frame is built up, and which is carried by the traveller frame.

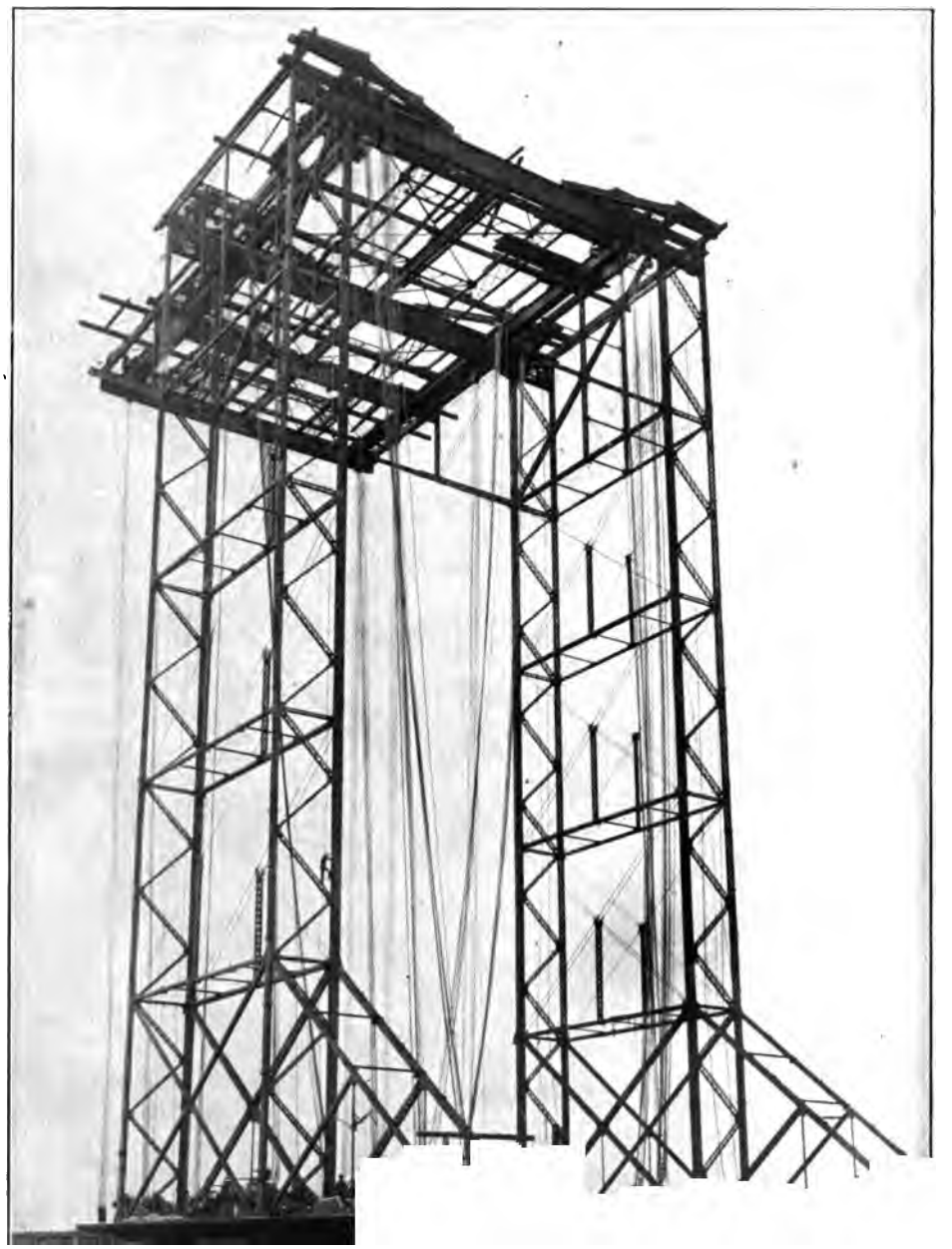


5. View of big traveller in full working condition. Date, August 8, 1905.

6. View of an anchor arm lower chord and splice plates. Date, Aug. 11, 1905. Note the arrangement of the seven splice plates.

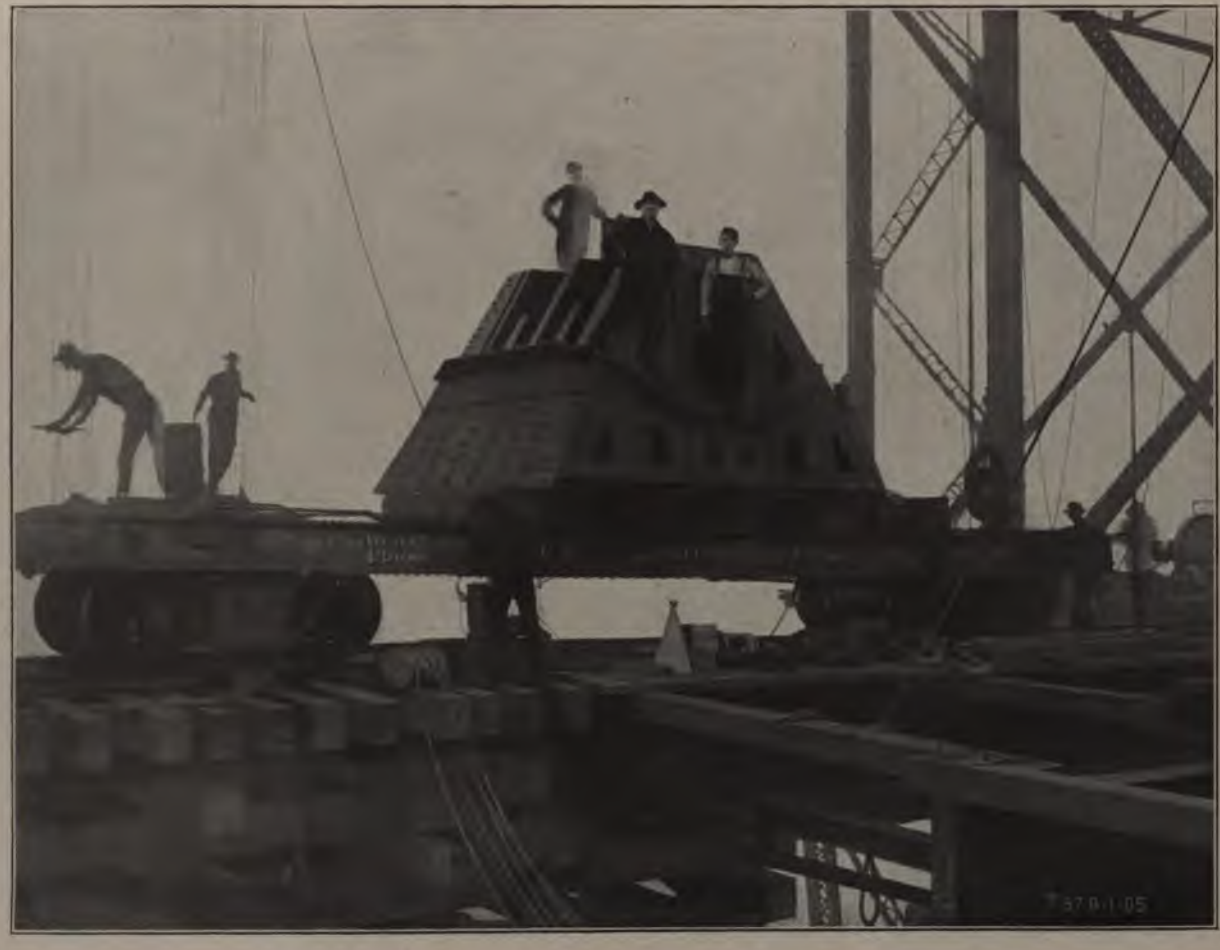


7. View of centre post shoe on car. Date, Sept. 1, 1905.



5. View of big traveller in full working condition. Date, August 8, 1905.

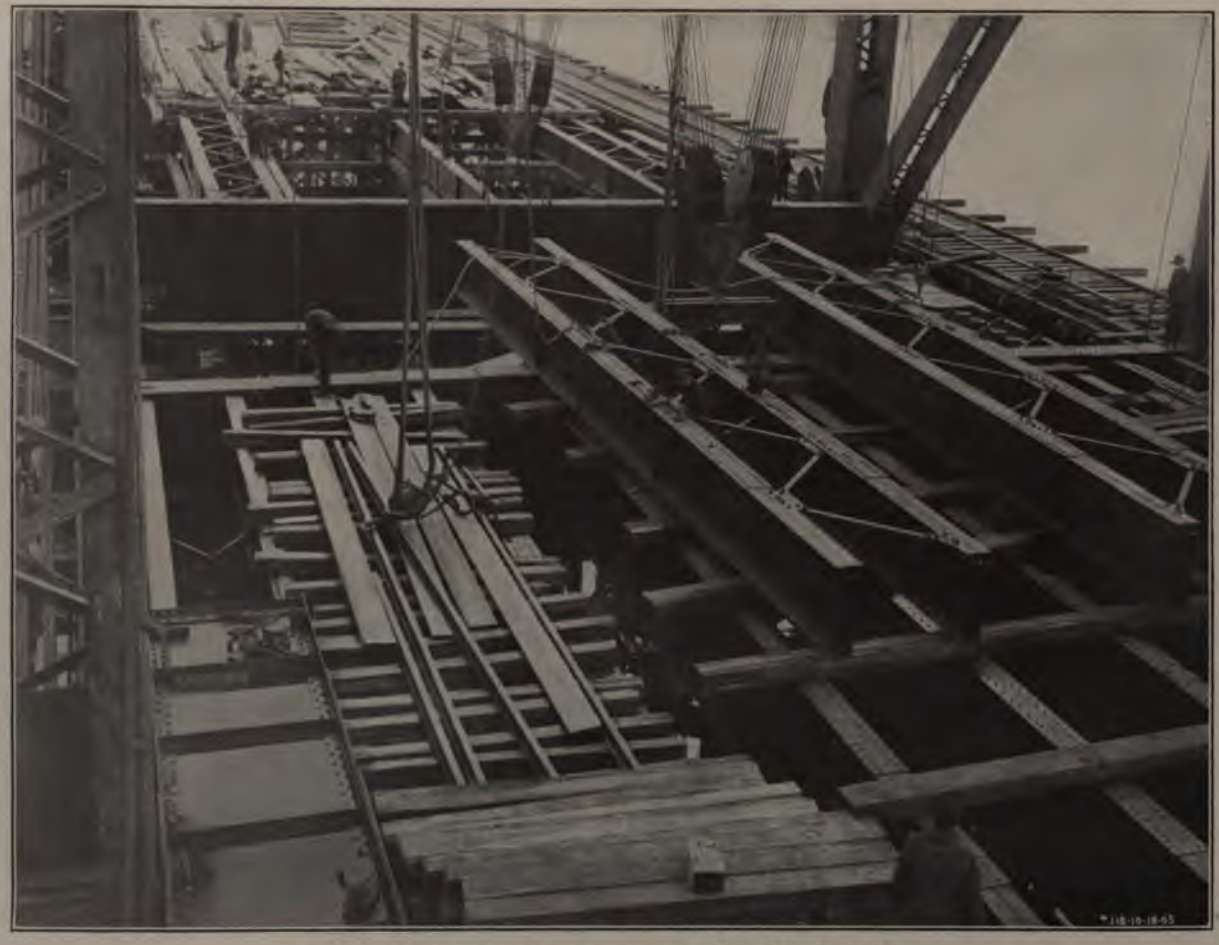
6. View of an anchor arm lower chord and splice plates. Date, Aug. 11, 1905. Note the arrangement of the seven splice plates.



7. View of centre post shoe on car. Date, Sept. 1, 1905.

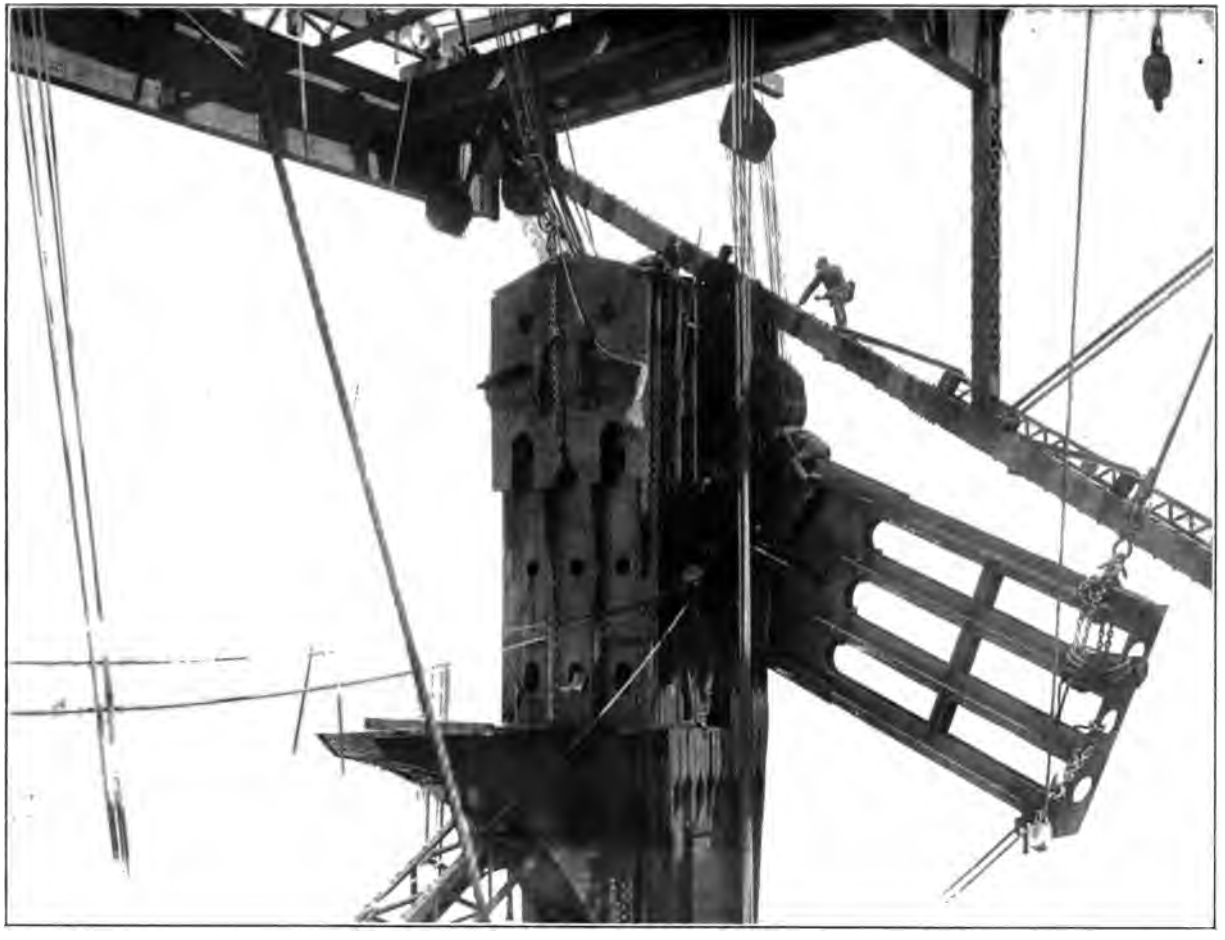
8. View of centre post shoe, pedestals and stub chords, left truss. Date, Sept. 8, 1905.

9. View of portal. Date, Oct. 9, 1905.



10. View of stringers and floor beams. Date, Oct. 19, 1905.

11. View of a centre post section being lifted by the traveller. Date, May 21, 1906.



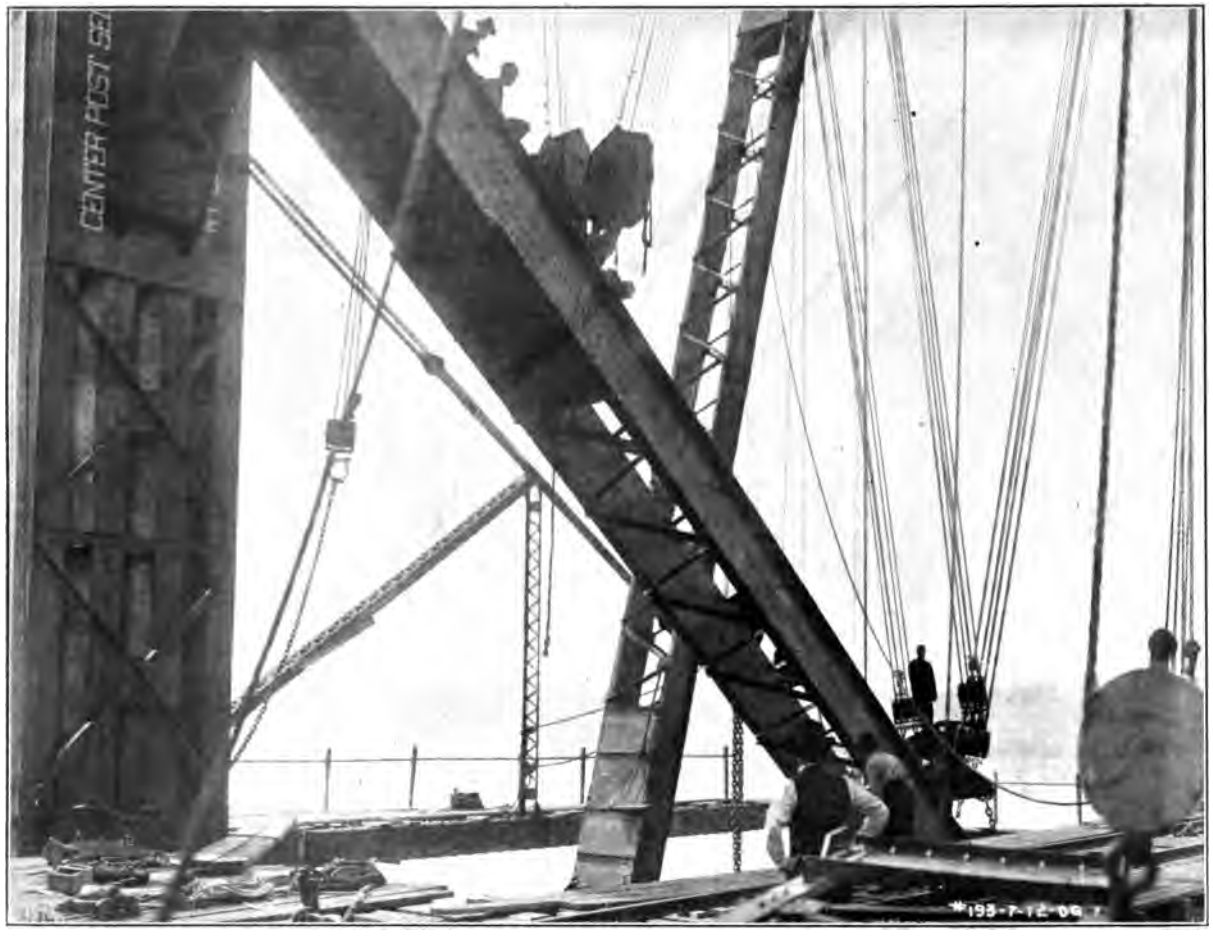
12. View showing the erection of a centre post cap. Date, June 15, 1906. Note that the cap could not be transported and erected as one piece and was built in three sections.

13. Second view of the erection of a centre post cap.

14. View showing the raising of a set of top chord eyebars. Date, June 20, 1905. Note the various tackles.

15. View showing the driving of a pin in the centre post cap. Date, June 25, 1906.

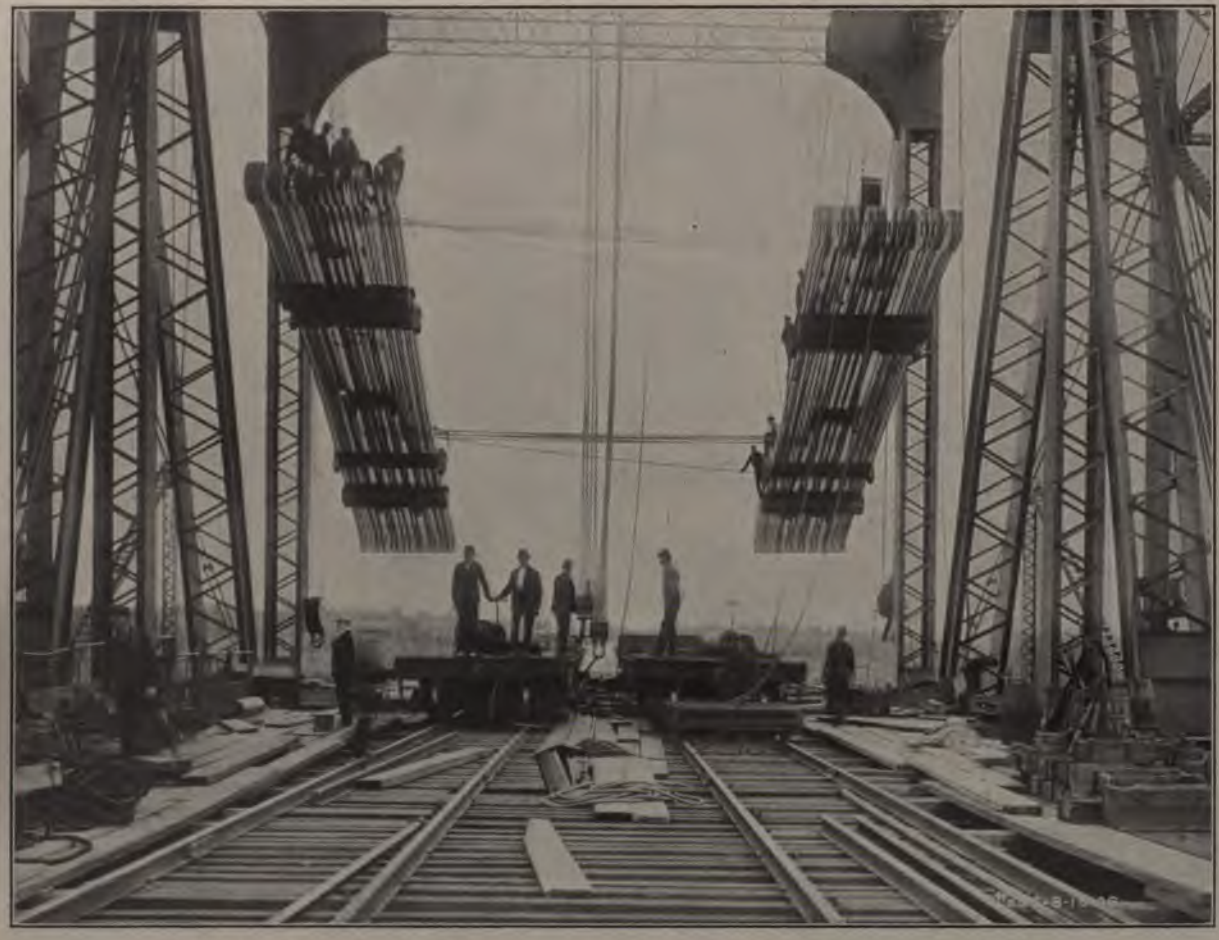
16. View showing the erection of a cantilever arm, lower chord. Date, July 5, 1906. Note the latticing of this chord which is No. 10 in the right truss.



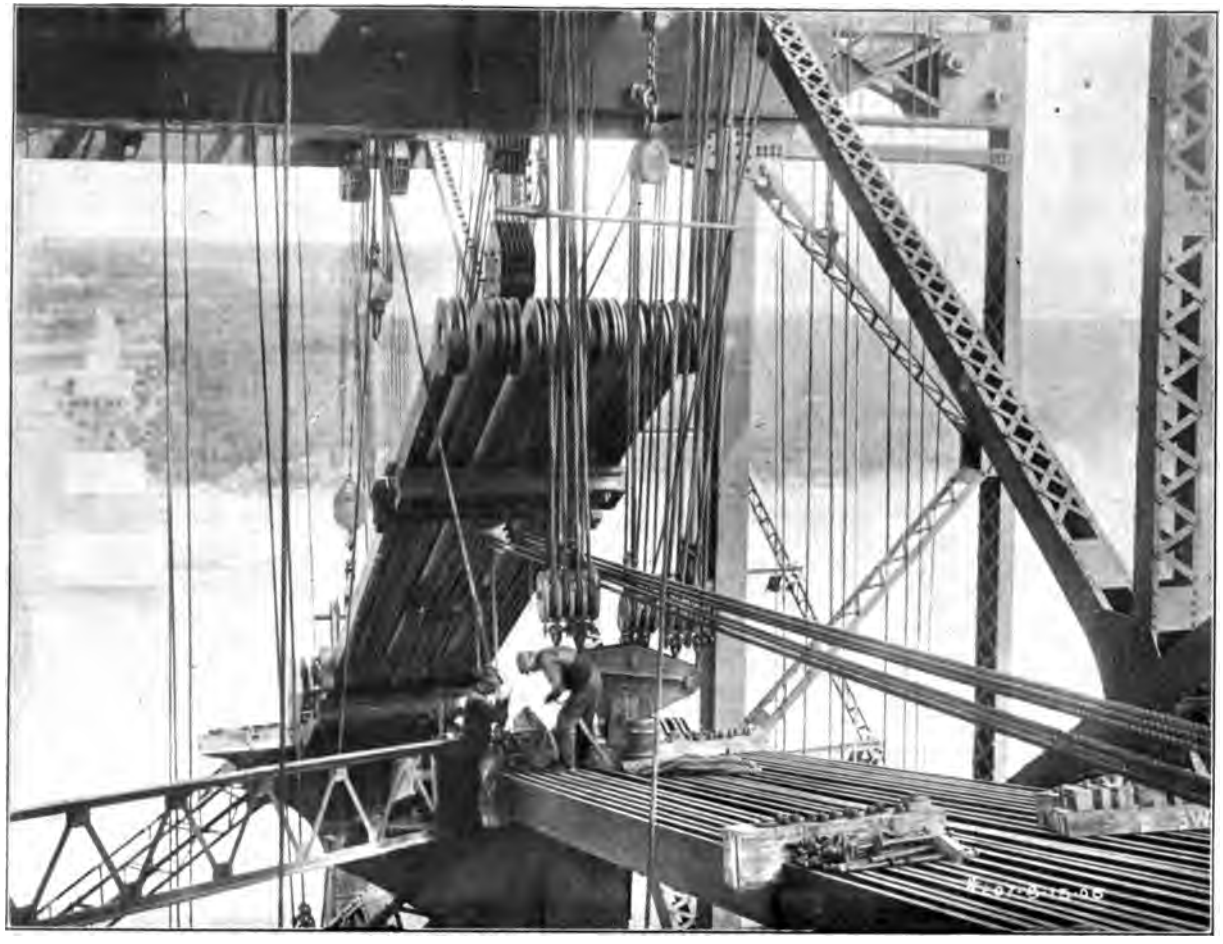
17. View showing erection near the centre post. Date, July 12, 1906.

18. View showing suspended girder used for carrying the traveller track for the erection of the cantilever arm. Date, July 18, 1906.

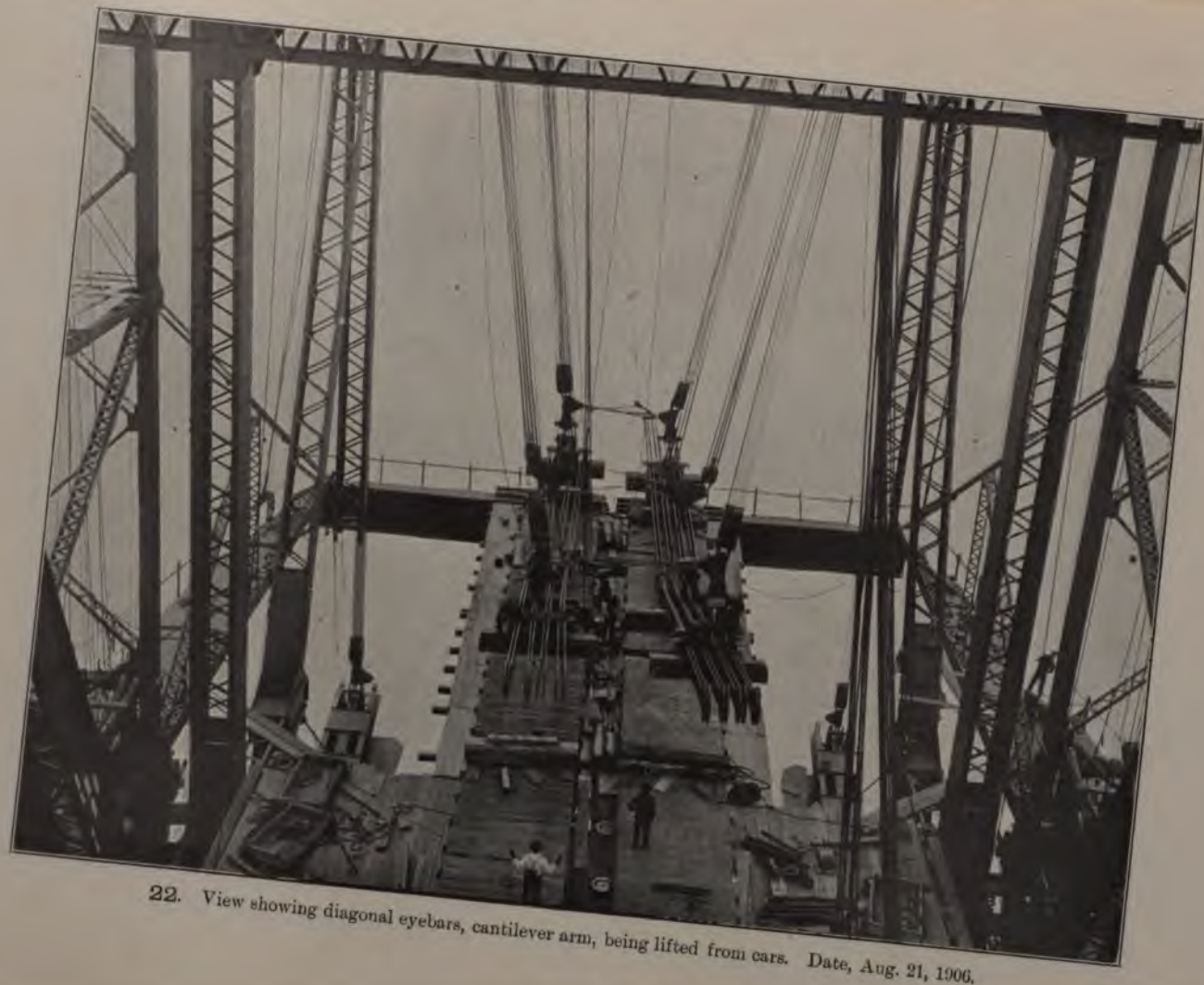
19. View showing the erection of an upper post section, cantilever arm. Date, Aug. 13, 1906.



20. View showing traveller lifting two groups of eyebars, cantilever arm. Date, Aug. 15, 1906.



21. View showing the erection of upper chord eyebars, cantilever arm. Date, Aug. 15, 1906.

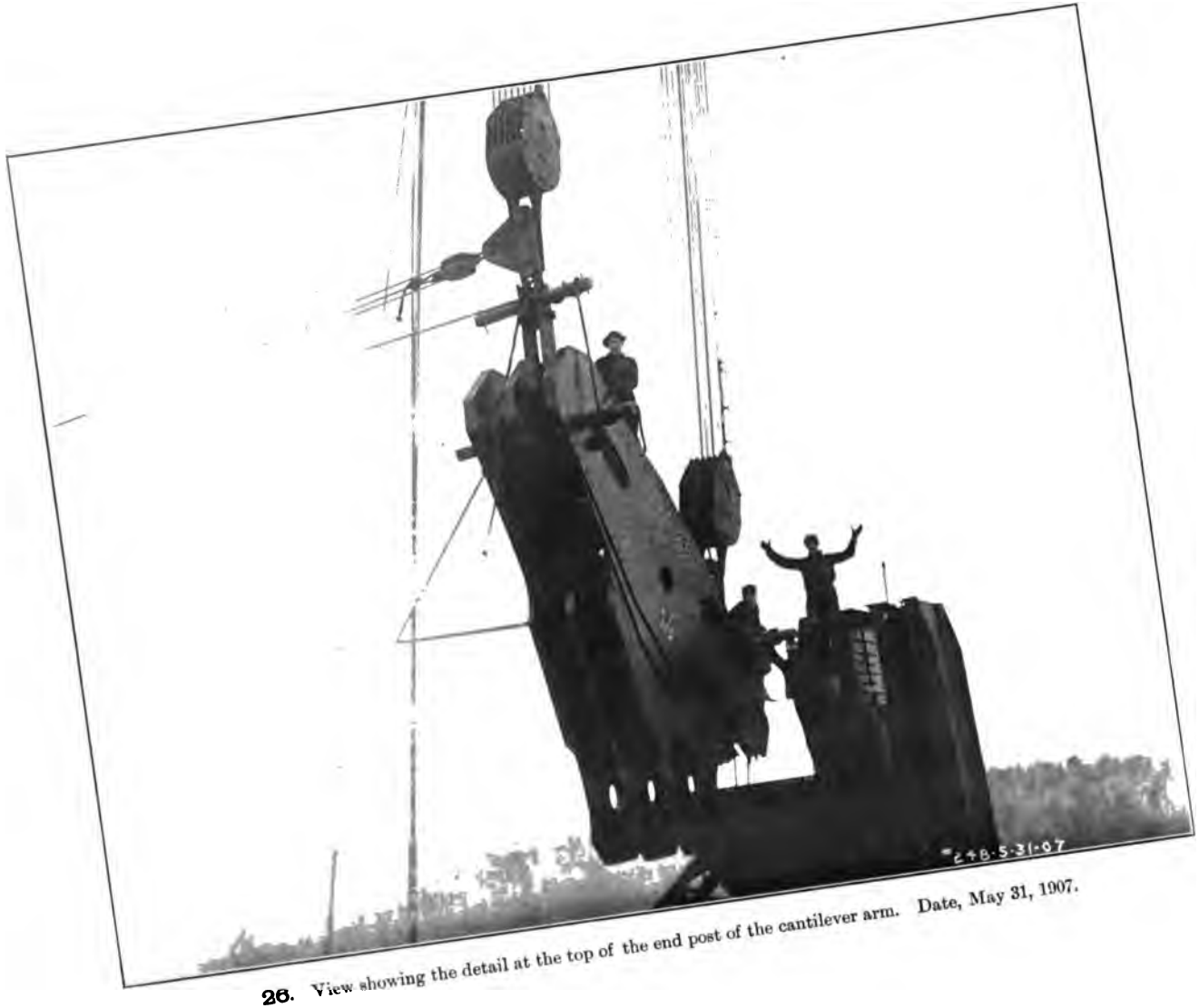


22. View showing diagonal eyebars, cantilever arm, being lifted from cars. Date, Aug. 21, 1906.

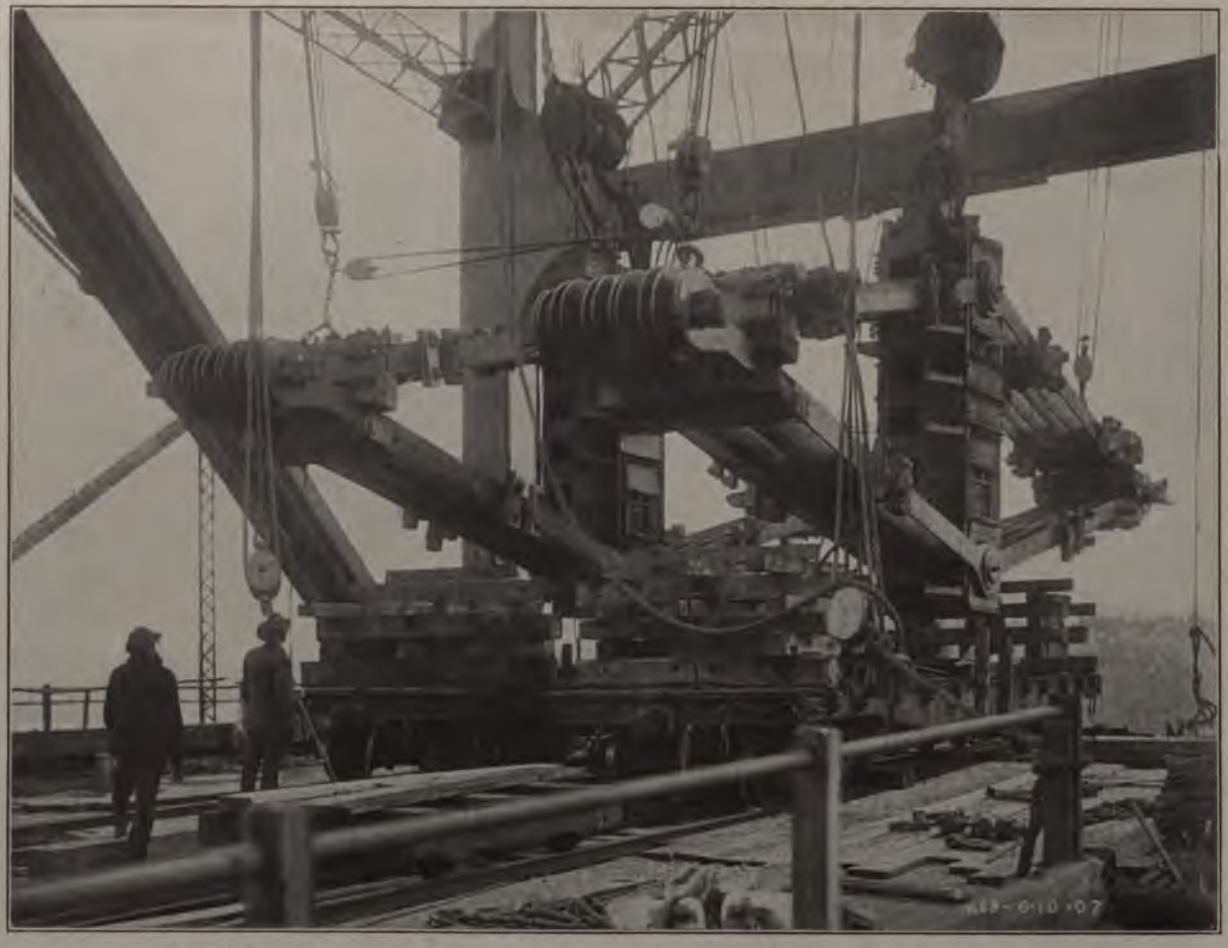
23. View showing the erection of a floor beam, cantilever arm. Date, Sept. 10, 1906.

24. View showing the method of moving a suspended girder forward for the erection of a new panel. Date, Sept. 22, 1906.

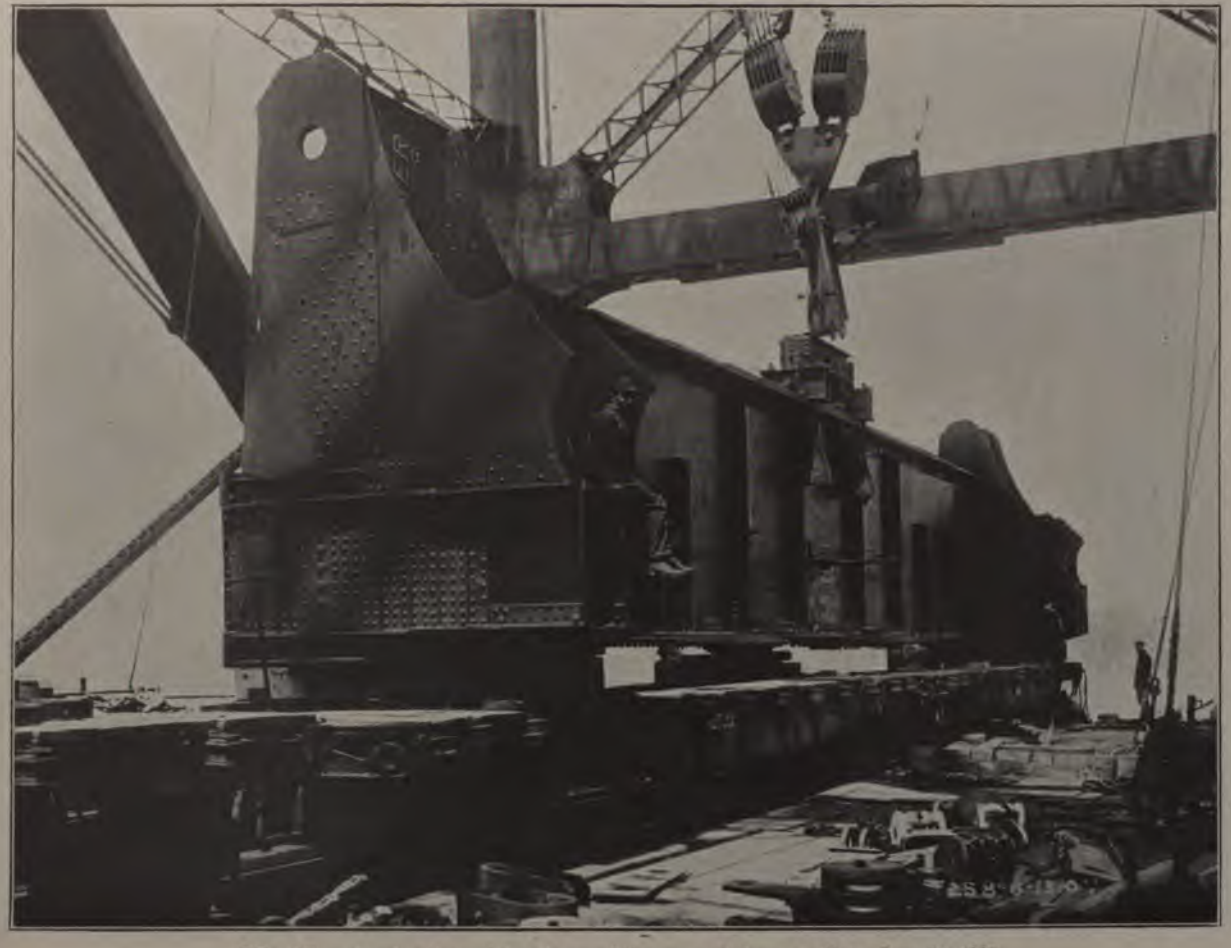
25. View showing the erection of a main post, cantilever arm. Date, Nov. 21, 1906.



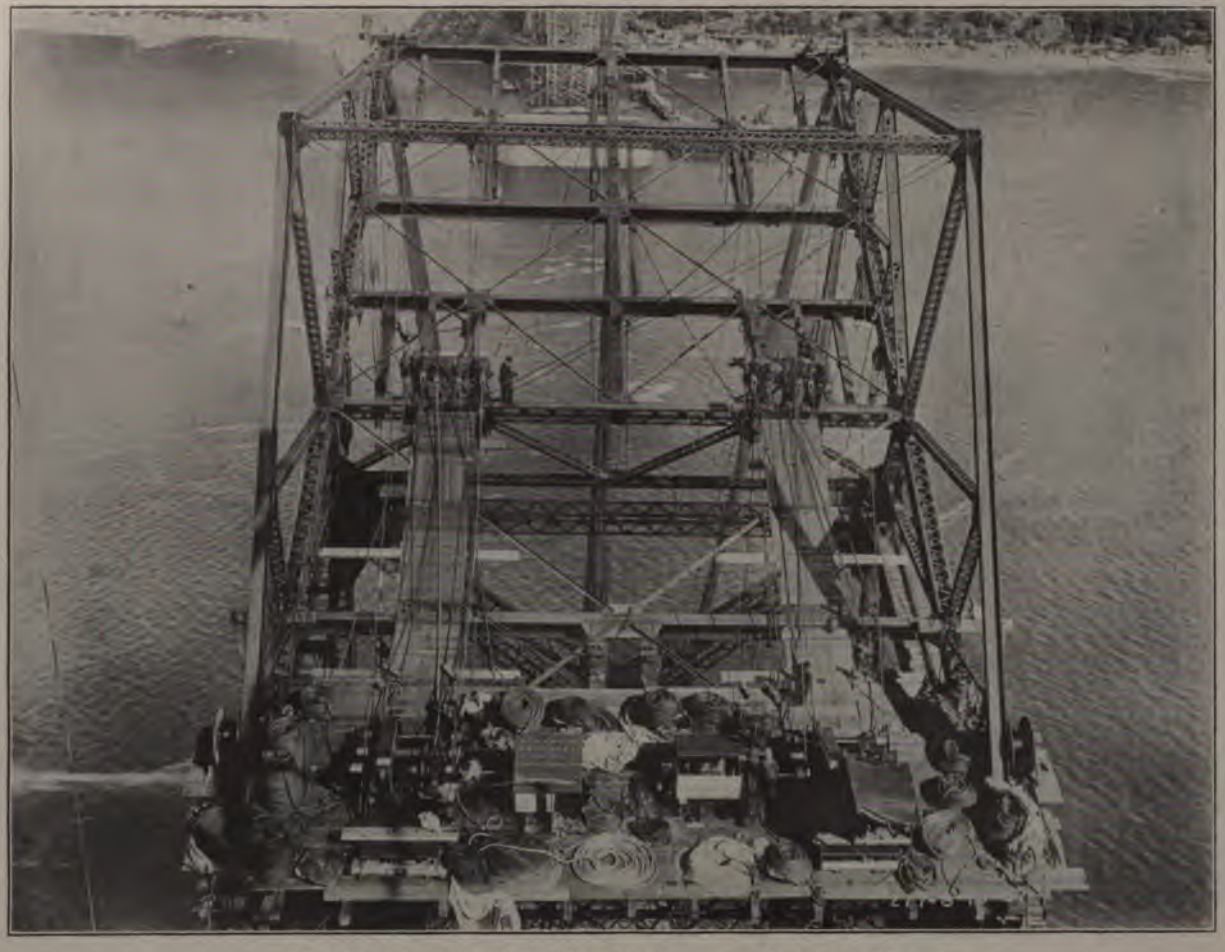
26. View showing the detail at the top of the end post of the cantilever arm. Date, May 31, 1907.



27. View showing the adjustable toggles for moving the suspended span. Date, June 10, 1907.



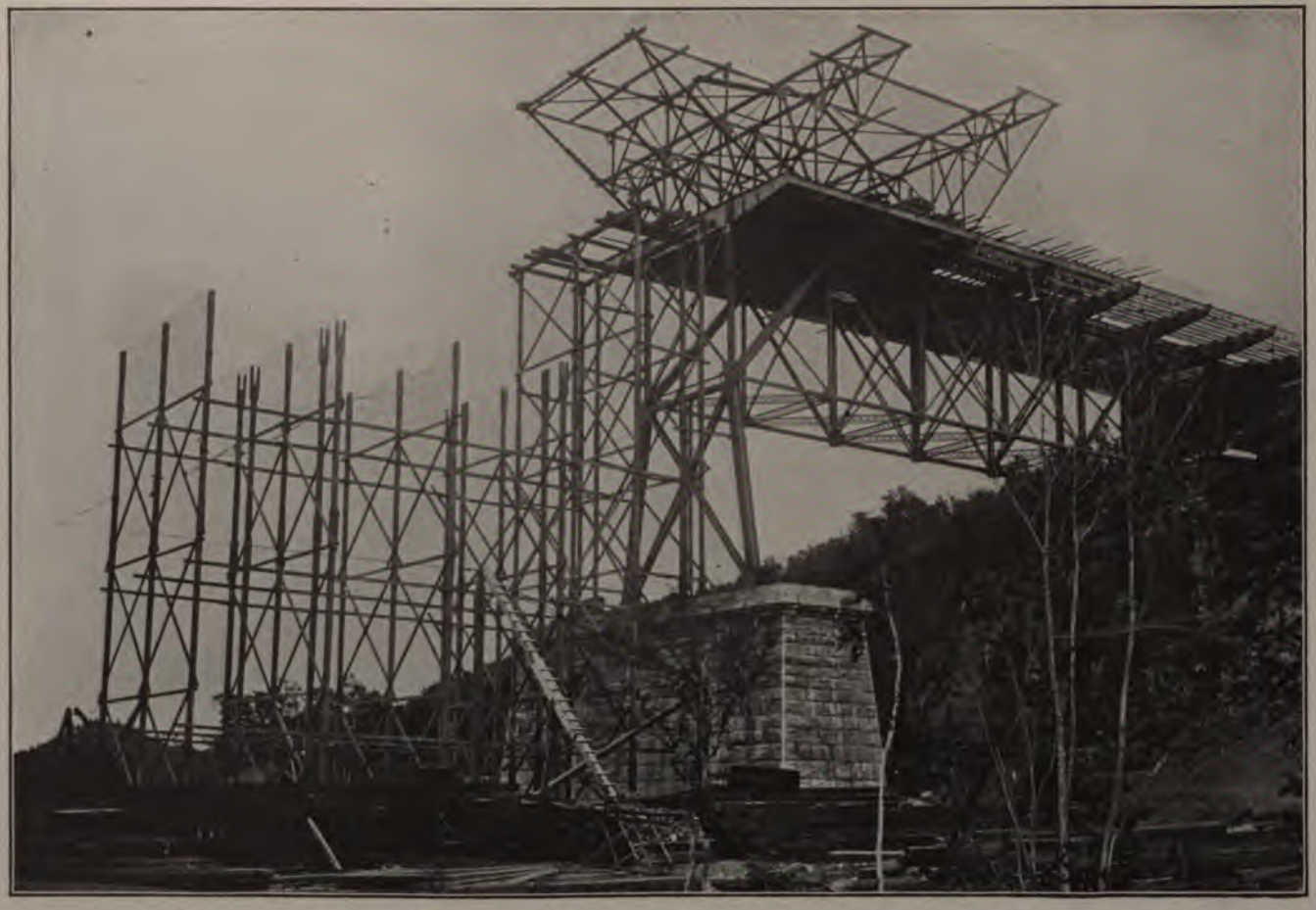
28. View showing the end floor beam of the suspended span. Date, June 13, 1907.



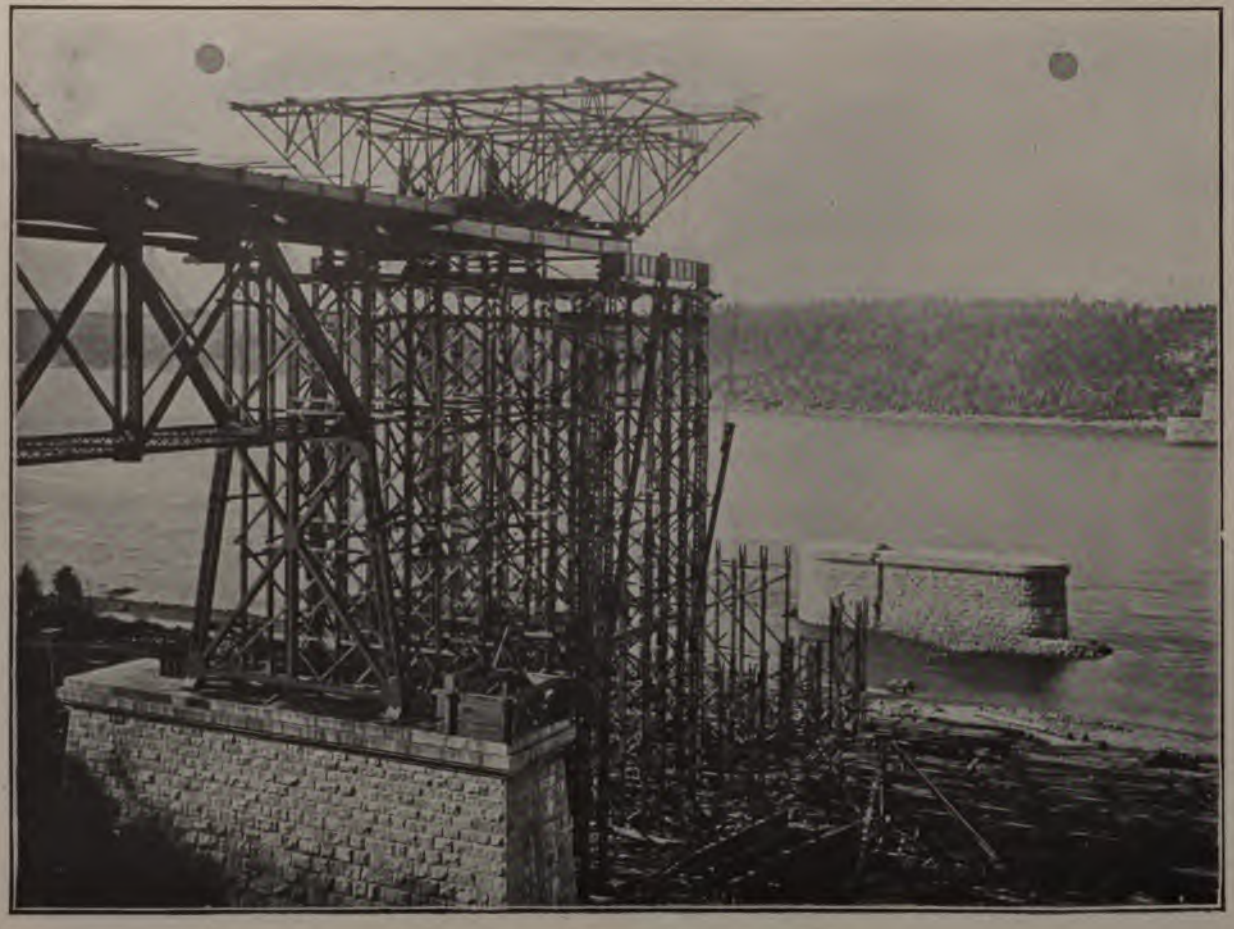
29. View showing little traveller whilst erecting. Date, Aug. 15, 1907.

EXHIBIT No. 127

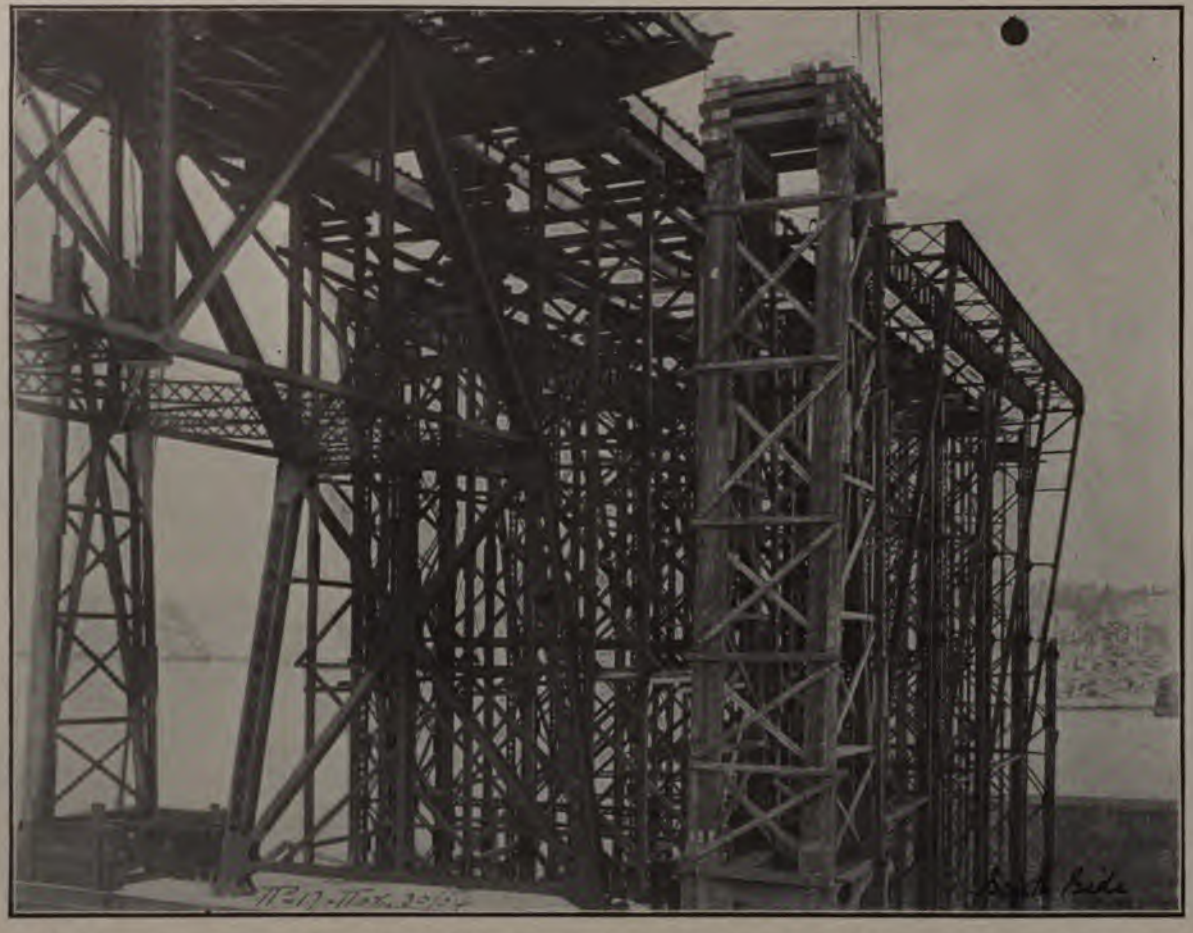
1. View showing the preparation of foundations for false work on south shore and assembling of material. Date, Aug. 10, 1904.



2. View showing traveller for erecting false work and wooden false work in course of erection. Date, Sept. 4, 1904.

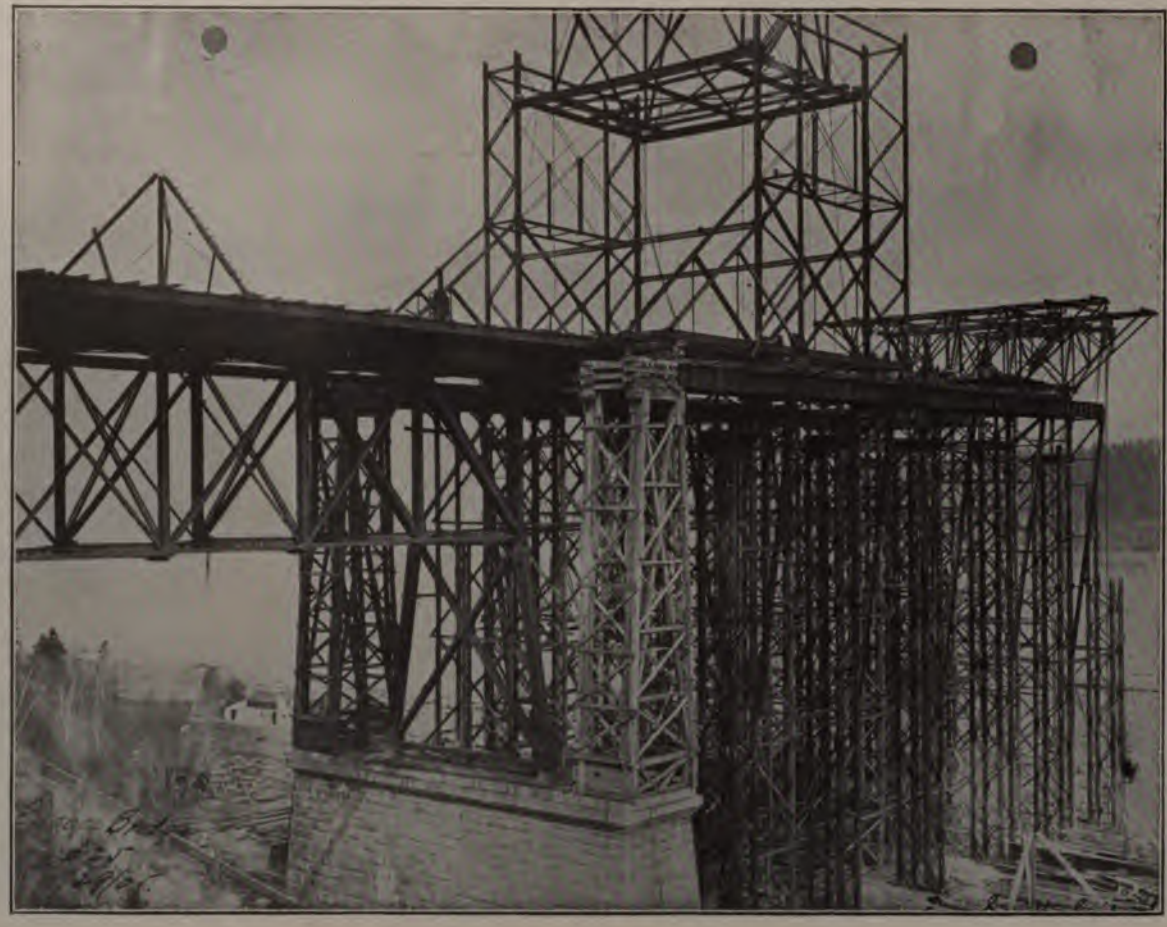


3. View showing progress. Date, Oct. 16, 1904.



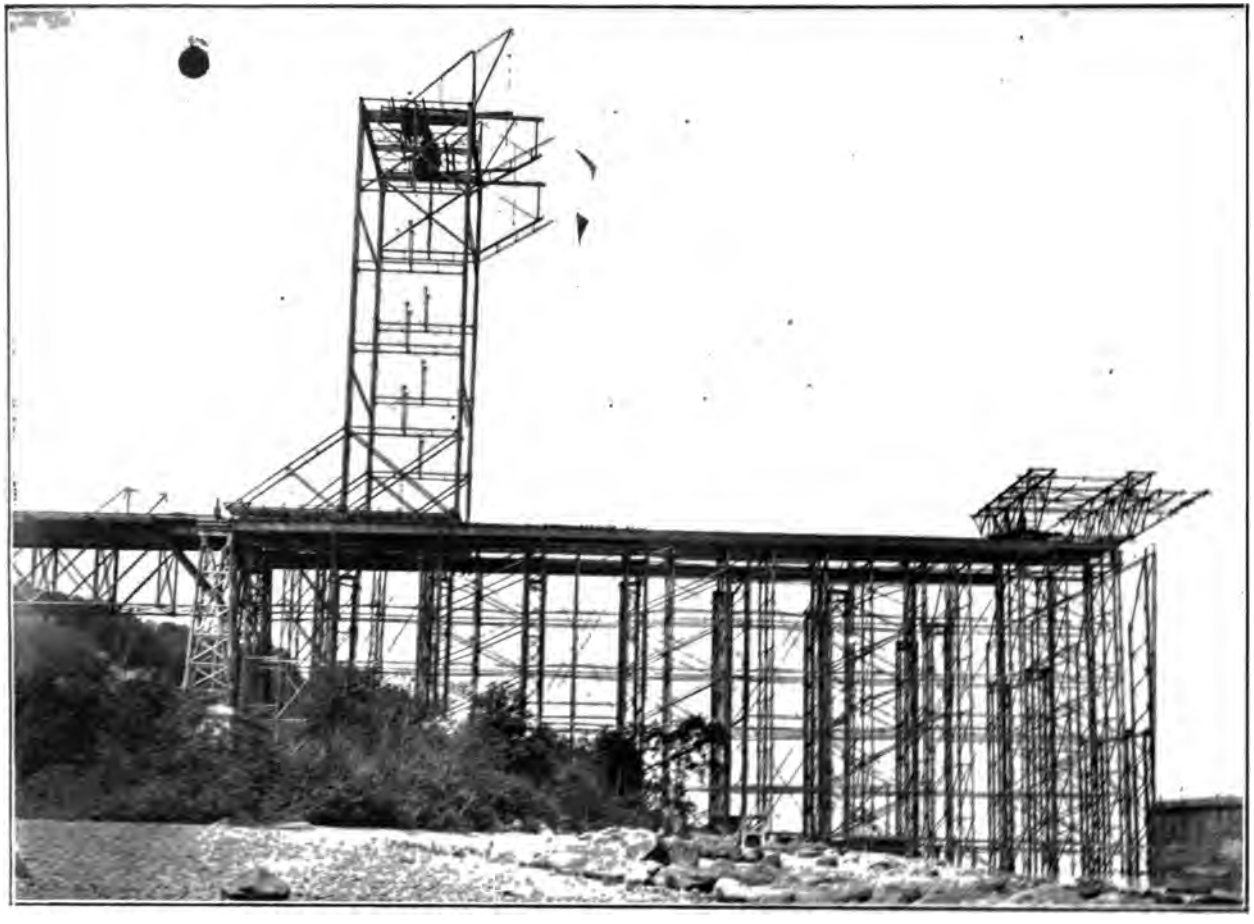
4. View showing progress. Date, Nov. 30, 1904. Note the four finished towers of steel false work and the wooden tower on the anchor pier.

5. View showing progress. Date, April 15, 1905. Note that the erection of the big traveller is well started.

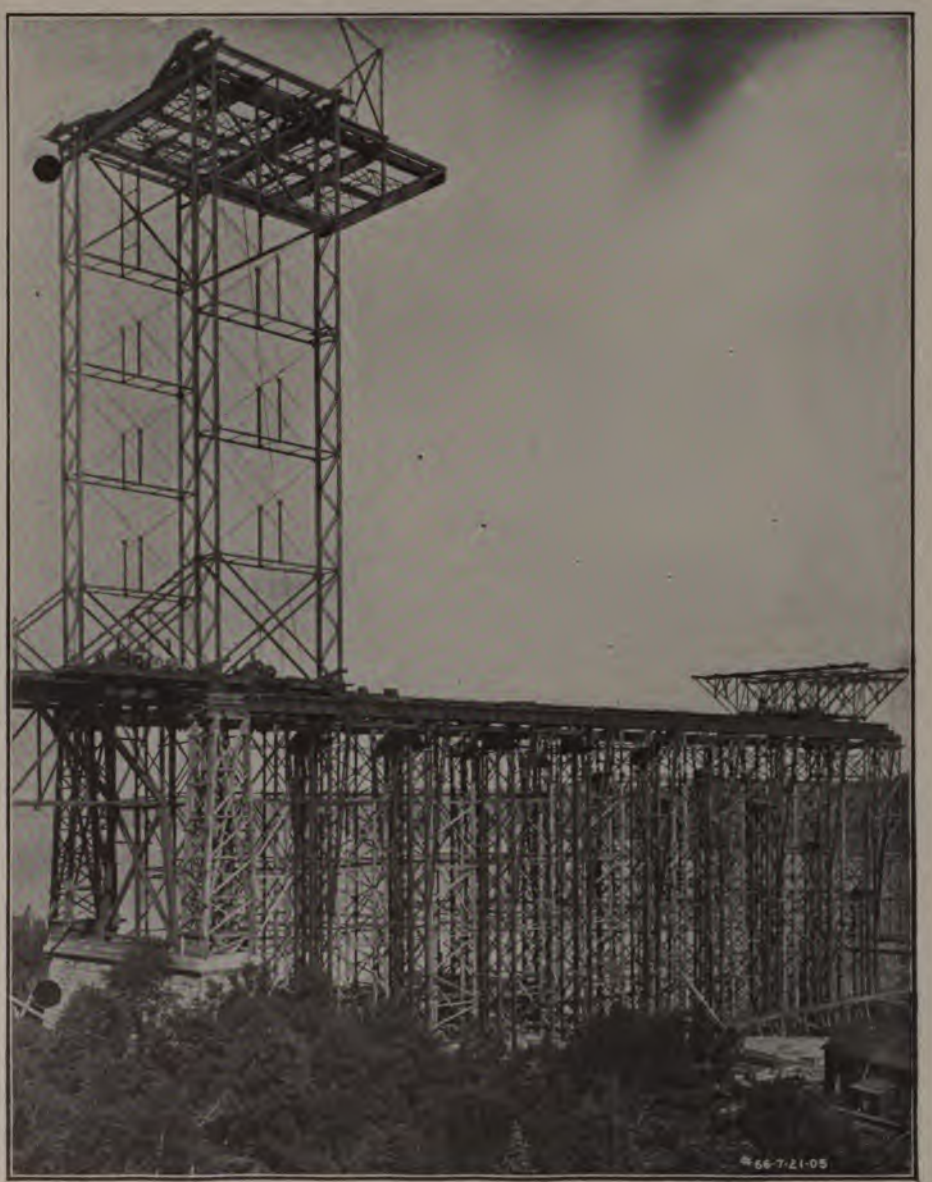


6. View showing progress. Date, April 29, 1905.

7. View showing the Quebec Bridge and Railway Company's bridge over the Chaudière river in course of construction. Date, May 25, 1905. The erection of the main bridge could not be commenced until this was completed.



8. View showing progress. Date, July 1, 1905.

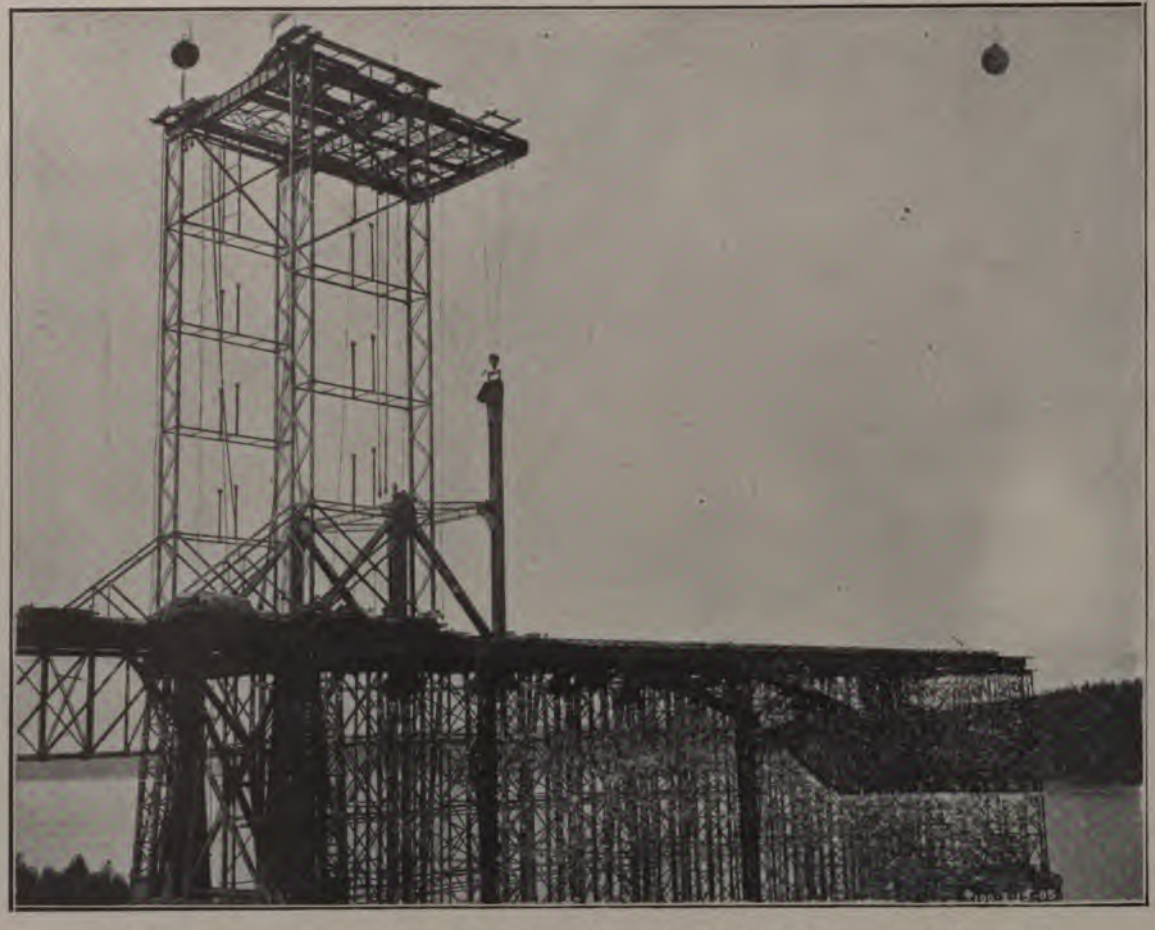


9. View showing progress. Date, July 21, 1905. Erection began on the next day.

10. View showing progress. Date, July 27, 1905. Note the towers on the anchor pier which were the first parts of the main bridge to be erected.

11. View showing progress. Date, Aug. 15, 1905. The lower chords of the anchor arm are being set.

12. View showing progress. Date, Aug. 25, 1905. Note the lower chords.

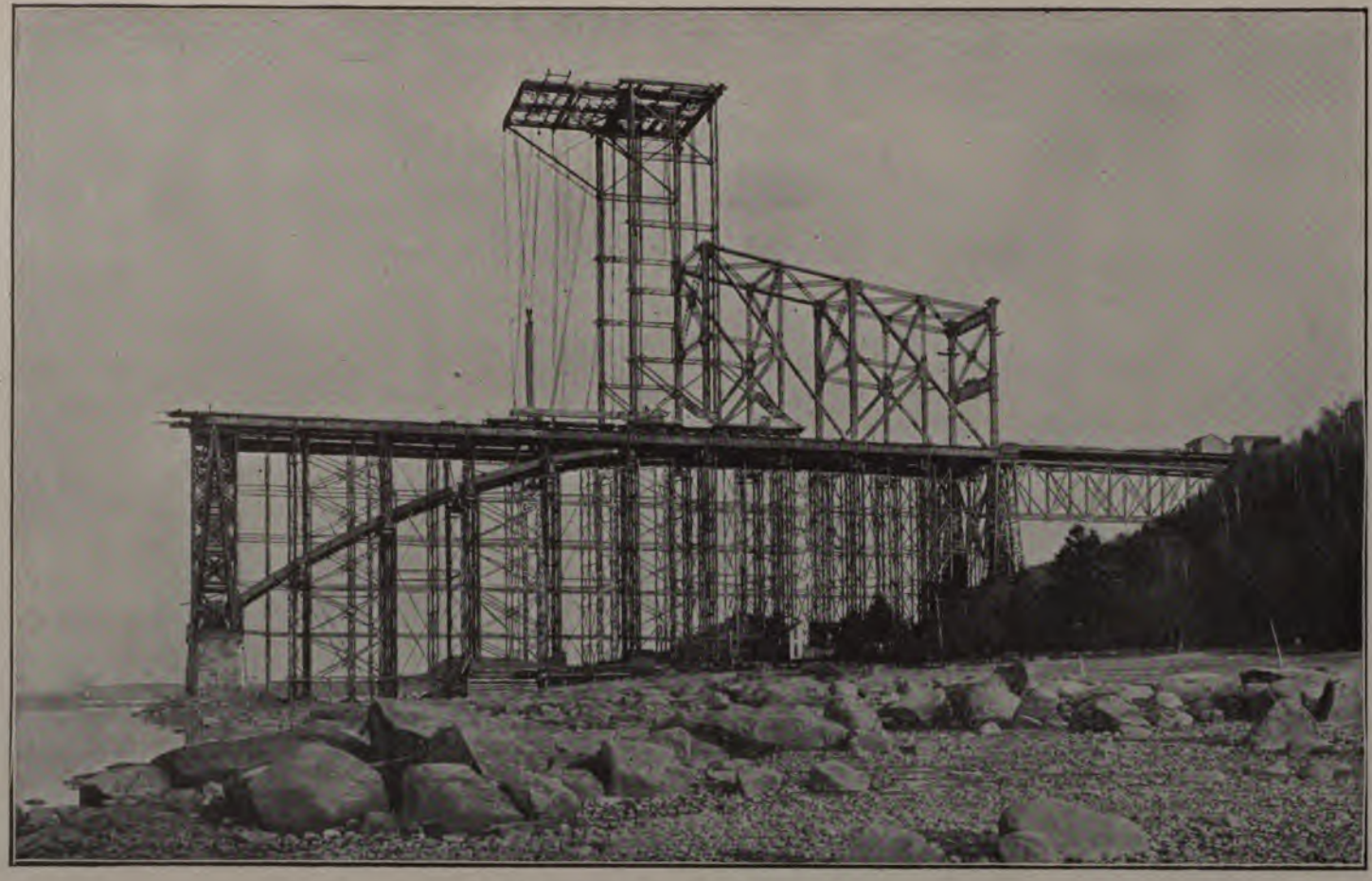


14. View showing progress. Date, Sept. 19, 1905. Panels 1 and 2 of the anchor arm are being erected.

14. View showing progress. Date, Sept. 19, 1905. Panels 1 and 2 of the anchor arm are being erected.

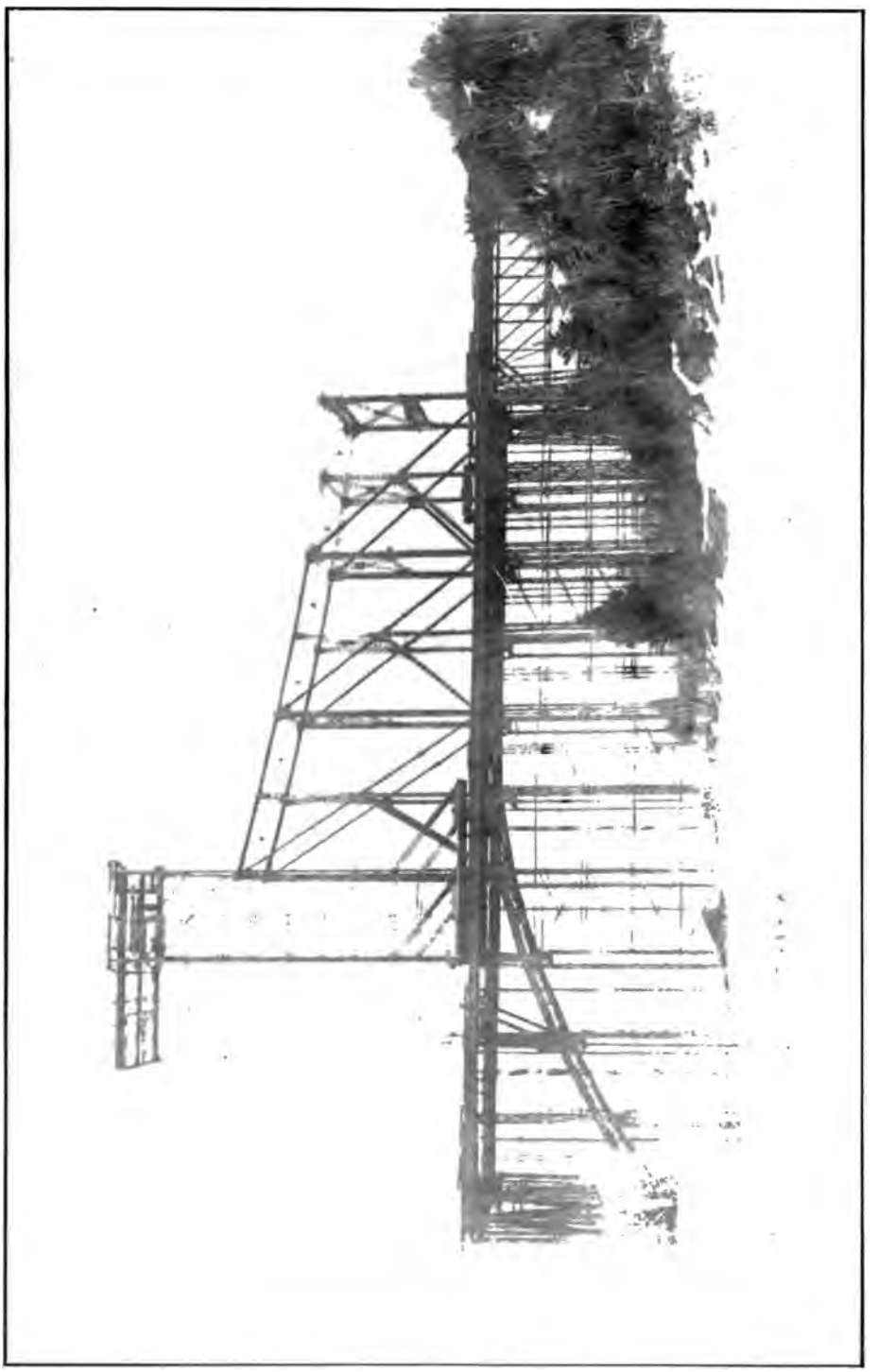
16. View showing progress. Date, Oct. 30, 1905.

15. View showing progress. Date, Oct. 10, 1905. Note that the portal has been completed.

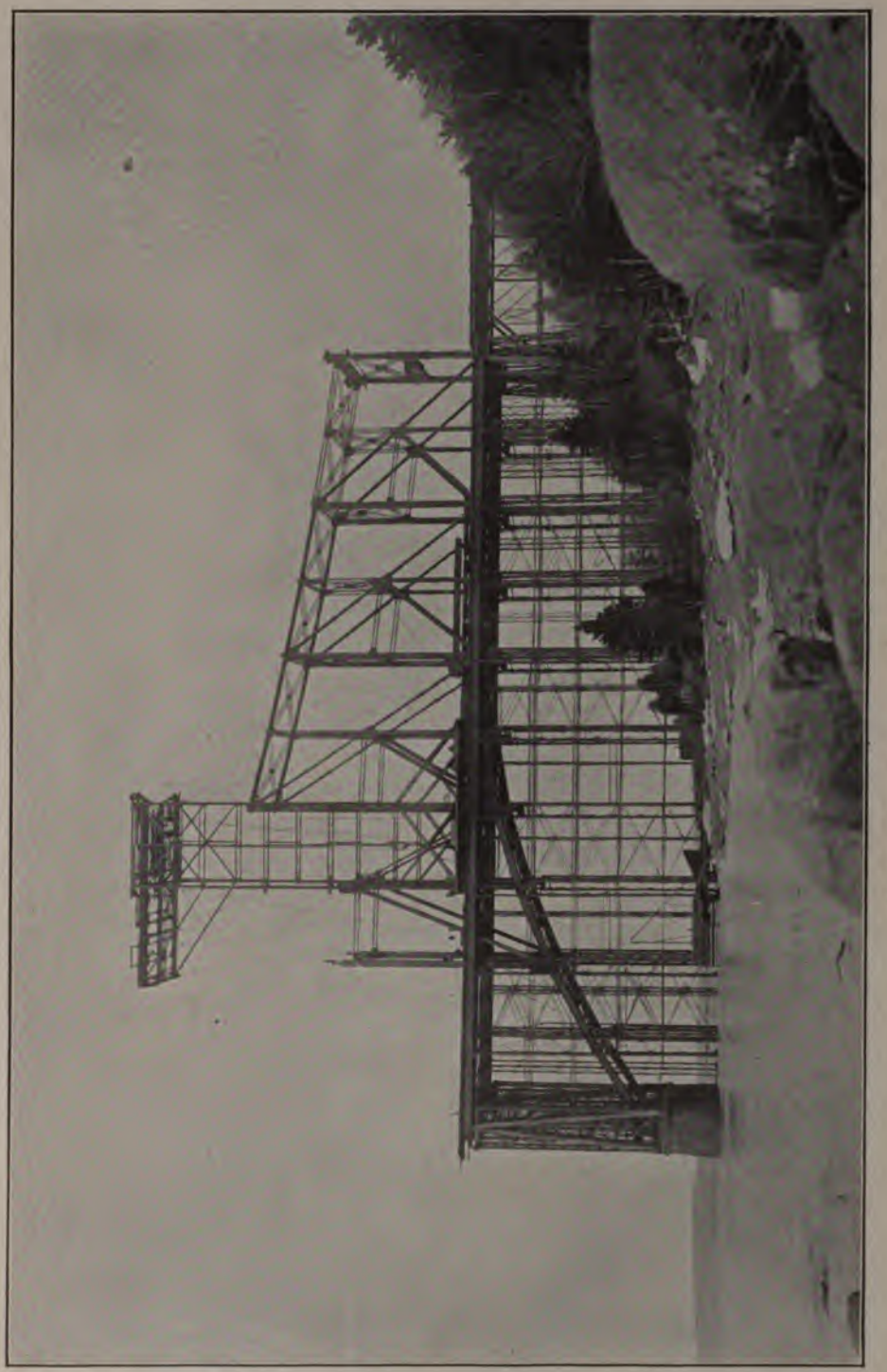


16. View showing progress. Date, Oct. 30, 1905.

17. View showing progress. Date, Nov. 23, 1905. Erection for the season is completed.



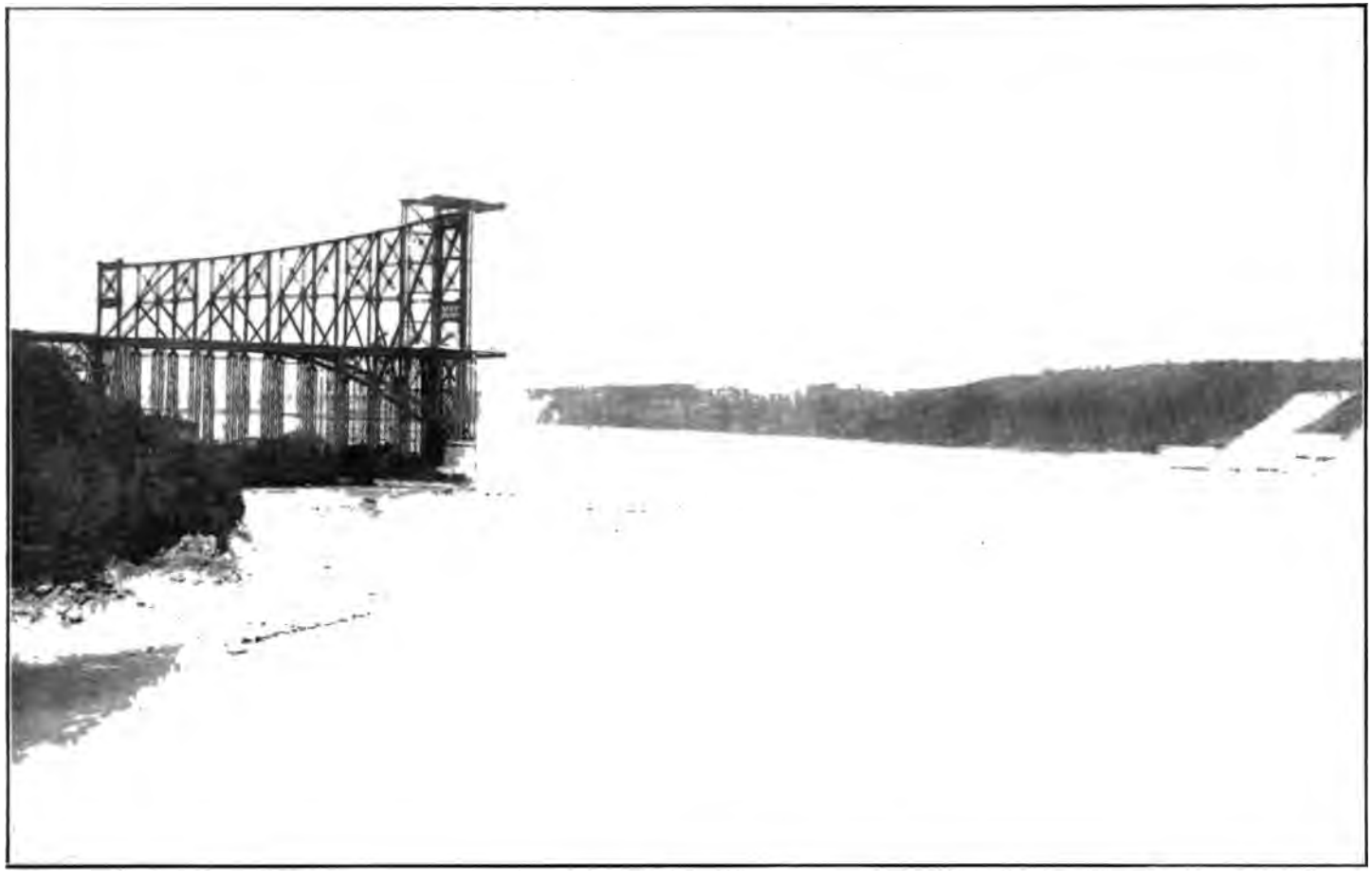
18. View showing progress. Date, April 18, 1906. The traveller is ready to recommence erection.



19. View showing progress. Date, April 25, 1906.

20. View showing progress. Date, April 29, 1906.

21. View showing progress. Date, May 30, 1906. Note the progress on the centre posts.



22. View showing progress. Date, July 3, 1906. Note that the anchor arm is practically finished.

23. View showing progress. Date, July 9, 1906. Note that the erection of the cantilever arm has been commenced.

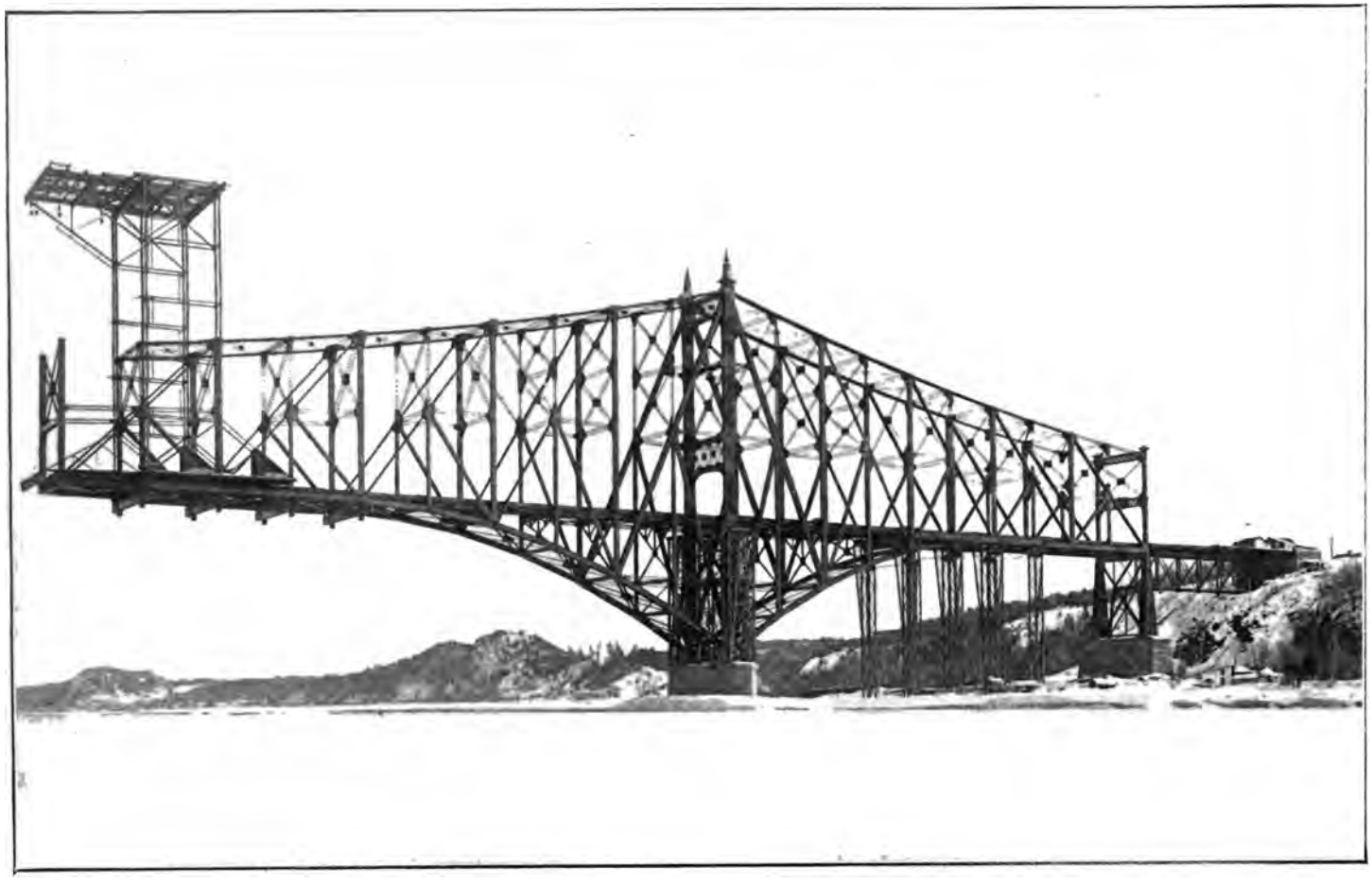
24. View showing progress. Date, July 31, 1906

25. View showing progress. Date, Aug. 28, 1906.

26. View showing progress. Date, Sept. 30, 1906. Note that the wooden tower on the anchor pier has been removed.

27. View showing progress. Date, Oct. 31, 1906. Note that the removal of the steel false work has been commenced.

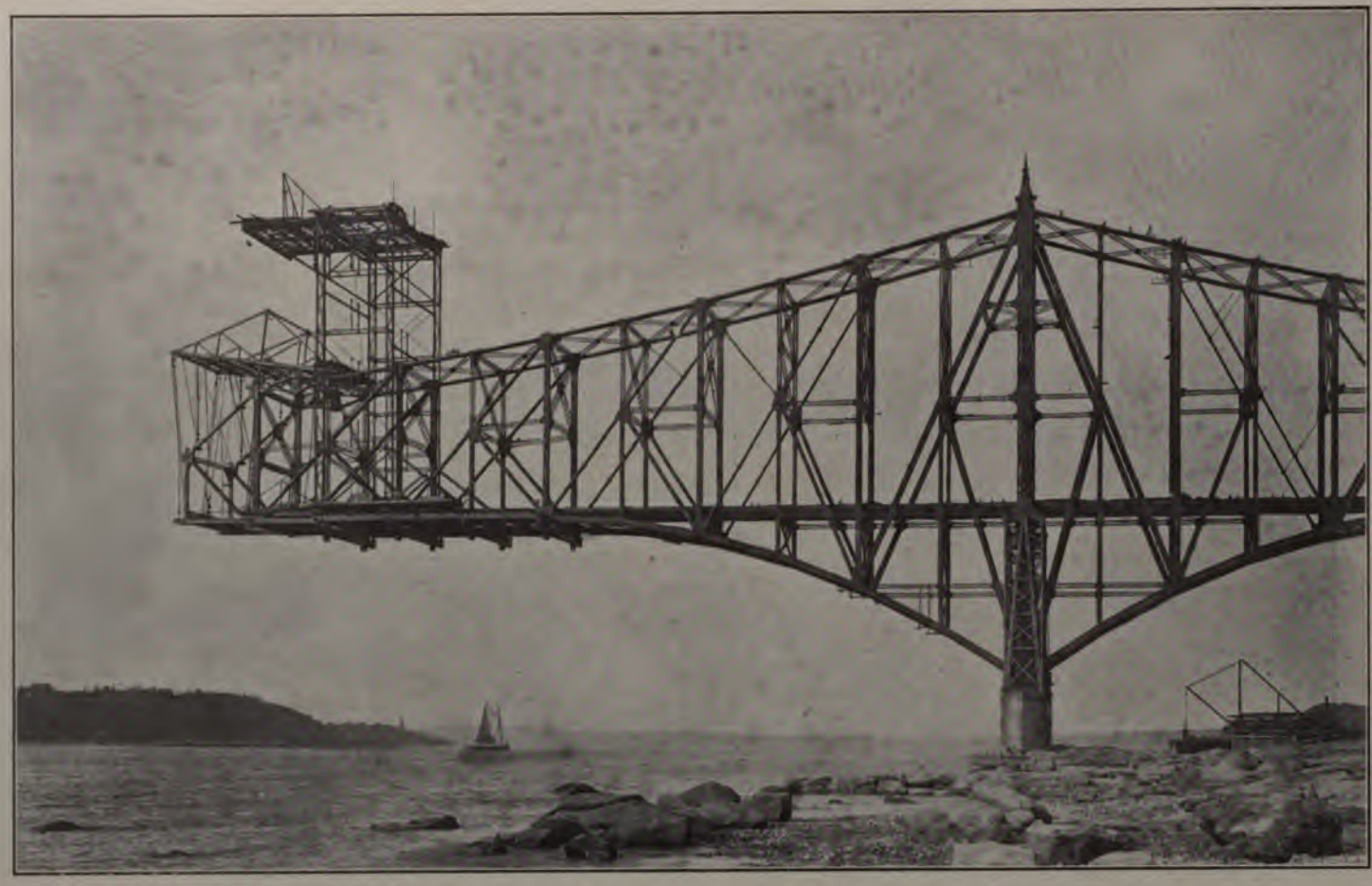
28. View showing progress. Date, Nov. 29, 1906. Erection for the season is completed, the cantilever arm being practically finished. Note the steel falsework.



29. View showing condition. Date, February 24, 1907.

30. View showing progress. Date, May 31, 1907. Note that the traveller has recommenced erection.

31. View showing progress. Date, June 12, 1907. Note the links for adjusting the position of the suspended span.



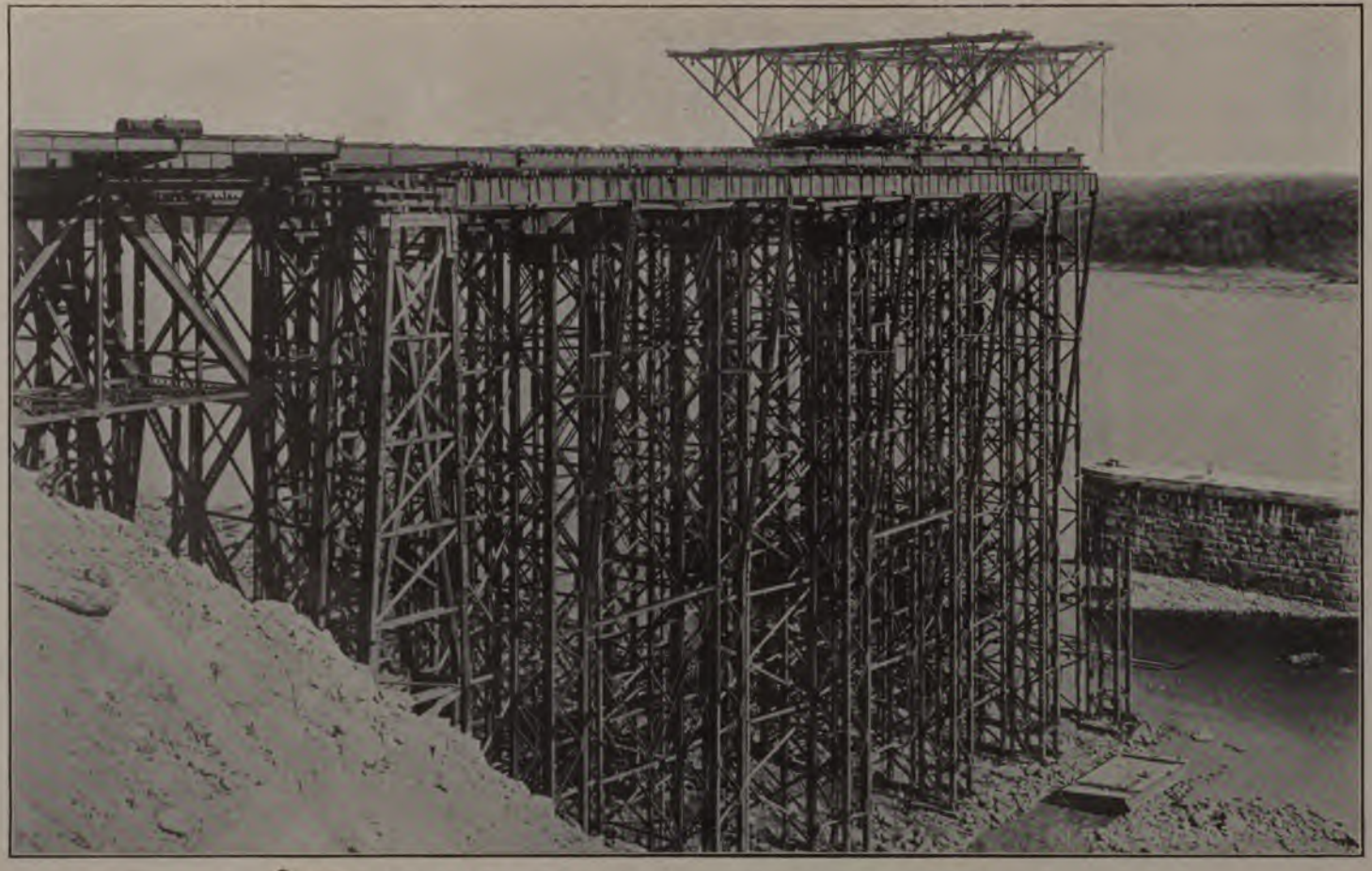
32. View showing progress. Date, July 14, 1907. Note that the little traveller has been built and is erecting.

33. View showing progress. Date, Aug. 5, 1907.

34. View showing progress. Date, Aug. 23, 1907. Note that the third panel of the suspended span has been erected.

34. View showing progress. Date, Aug. 23, 1907. Note that the third panel of the suspended span has been erected.

35. View showing progress. Date, Aug. 28, 1907. Note that the little traveller has been moved forward into position for erecting the fourth panel of the suspended span. Note also the condition of the big traveller.



36. View of the falsework on the north shore. Date, Aug. 15, 1907.